THE IRON TRADE REVIEW

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SOUND CONDITIONS

MARK THE OPENING OF THE SECOND QUARTER.

Railroads More Disposed Toward Buying.—Steel Corporation Made Good March Records.—Pig Iron Quiet.

The opening of the second quarter of the year finds the iron market in a thoroughly sound condition. The one fear which has been entertained to some extent was that the railroads might curtail buying. Cancellations of contracts by railroad interests have been few and indications are that buying will be resumed on an extensive scale. The United States Steel Corporation, being in need of cars on a number of its railroads, expressed its willingness to have its name entered in the places of any companies which might cancel contracts for rolling stock, and this action has been an important factor in causing a more confident feeling and perhaps in checking cancellations. The Wabash railroad, which recently ceased operation on new improvements in the Pittsburg district, has resumed work.

Record Breaking. While complete returns are not yet available, it is known that in spite of the heavy handicap imposed by the floods in the Pittsburg district the Steel Corporation broke numerous individual records during March—particularly those plants most favorably located—and in all lines the aggregate output was near the highest existing figures. The Corporation furnaces turned out in the neighborhood of 1,000,000 tons, the record being only about 8,000 tons above this figure. At present only five Corporation furnaces are out of blast, giving a producing percentage of about 96 per cent. One new Carrie furnace is to be blown in soon after May 1 and several of those now being repaired will soon be ready for the torch. October will be the next month suited for a trial at record-breaking.

Pig Iron is Quiet. Blast furnaces throughout the eastern district are sold fully five months ahead, and in the central west a considerable number of furnaces are sold six months ahead. Hence furnace interests are not anxious to sell, and, on the other hand, buyers are not eager to contract at the present time. The market is quiet but firm in the north. In the south, foreign competition is more strongly felt. Imported iron is now being delivered at New Orleans at $19.50, duty paid. Deliveries from the south have improved greatly and the tonnage on southern yards has been much reduced. Conditions in that section can be described as distinctly easier, although large producers are still very firm in their views of prices. The new freight rates are now effective after having been postponed two months. Consumers pay the freight.

Very Heavy Specifications. Specifications on nearly all kinds of finished material are the heaviest on record. Eastern mills which have been obtaining large premiums on plates are now supplied with orders for two or three months, and mills in the Pittsburg district cannot take orders for delivery before August or September. With the coming of milder weather, the already very heavy demand for wire products has increased, many orders coming from jobbers, and mills are overwhelmed with business. Heavy inquiries for standard section rails from steam lines are pending and traction interests are also prominent in the market.

Buying Steel Bars. Agricultural implement manufacturers have apparently abandoned all hope of obtaining the desired concession on steel bars and some of them have entered the market, contracting for only six months instead of for the year as they have done in the past. The demand for hoops and bands has improved. Increased orders are reported for structural shapes in nearly all centers. Merchant pipe and boiler tubes are selling in large tonnages.

DULUTH PLANTS

Will be Built by the United States Steel Corporation.—Furnaces and Mills.

(Special Telegram.)

New York, April 3.—After carefully considering the matter, the United States Steel Corporation has decided to install iron and steel works at Duluth, Minn., at a cost of several million dollars. Plans are not yet fully matured, but it is probable that only one blast furnace will be erected. Other installations will probably include six open-hearth furnaces, blooming, rail, sheet and bar mills, coke ovens, coal storage facilities and other accessories.

Shows Surplus.—The actual net profits for the year's operations ending Dec. 31, 1906, of the Herring-Hall-Marvin Safe Co., before charging off for depreciation were $102,049. A special reserve of $11,000 was established against possible losses and uncollectible accounts in San Francisco, due to the fire, and $31,666 was set aside for depreciation and maintenance. In addition, the company charged to expense $18,160 upon maintenance. These charges against the net earnings leave a balance for the year of $59,383. The balance sheet of Dec. 31, 1906, shows total assets of $1,512,506.

New Steel Company.—The Michigan Crucible Steel Co., with offices at 248-250 Guoin street, Detroit, has been organized for the manufacture of crucible steel castings, and will devote itself especially to automobile work. The company will be prepared to produce castings on or before May 1. The president and general manager of the company will be R. F. Flinterman, who has for some time past been in charge of the laboratories and foundry practice of the International Harvester Co.

THE WEEK IN IRON CENTERS.

PITTSBURG

Decided Change in Railroad Attitude—Action of President Corey.

Office of THE IRON TRADE REVIEW.
521 Park Building, April 2

Market conditions in the Pittsburg district at the beginning of the second quarter are stronger than they have been since the beginning of the big boom early last fall and the volume of tonnage contracts now on the books of producing companies is greater than at any time in their history, with consumers taking out practically the full quota of their contracts and specifications and specifying ahead for their requirements at a rate much beyond the capacity of mills to make shipments.

The recent excitement on the New York stock exchange caused a tendency toward a more cautious buying for far future requirements, but the suspensions have been very light and cancellations amounted to practically nothing at all. During the past week the railroad companies, which, at the beginning of the flurries, took the initiative in slowing up, have shown an inclination to specify, and probably the most potent factor in the whole situation was President Corey of the United States Steel Corporation when he told the leading car manufacturing interests of the country that, if any of the railroad interests cancelled or suspended their contracts for new carrying capacity, they should place the name of the Steel Corporation on the books in places vacated by the railroads for new cars, as the Steel Corporation was short of equipment on practically all of its many transportation interests. Since that time, two weeks ago, there has been no talk at all of further suspensions or cancellations, and the Wabash railroad, which was the first to announce a retrenchment policy on account of tight financial conditions and ordered suspensions of various new improvements in the Pittsburg district, has resumed operation on this work.

The National Tube Co. is swamped with business and as announced three weeks ago, has withdrawn all its quotations to shippers prior to June 1, and will accept orders only on the condition that they are taken at prices to be fixed before June 1, and for delivery after that date at the convenience of the company. The American Sheet & Tin Plate Co. in March had the biggest business of any March in the history of the company. The Carnegie Steel Co. has practically a million tons of steel bars on its books against which very heavy specifications covering requirements for five or six months have been made, and is practically out of the market on steel plates. There is scarcely an interest in the Pittsburg district using semi-finished material that is getting its full requirements or full deliveries on its contracts. This filled up condition is by no means true of the steel corporation interests alone, but exists in practically every branch of the trade.

The Carnegie Steel Co. has exercised its option on 10,000 tons of Bessemer iron at $22, valley furnace, for delivery during May. Another sale of 2,000 tons is reported for April, May and June shipment, at $23. For third quarter delivery, we note the sale of two lots of 9,000 and 1,000 tons respectively at $21, valley.

Pig Iron.—It has been estimated that the transactions in Bessemer pig iron during the month of March reached 65,000 tons. Pig iron for steel making purposes is scarcer at the beginning of the second quarter than it was last fall and prices are very firm, with indications of an advance before July 1 being much more probable than a decline, while the general feeling is that conditions will remain during the next three months about as they are at the present time. The sales reports during the week under review were 1,000 tons Bessemer for June delivery at $22.50, 1,000 tons basic for July delivery at $21, 3,000 tons basic for third quarter delivery at the same price. La Belle Iron Works sold 2,000 tons of basic at $22 Steubenville for second quarter. A large steel making interest in the Pittsburg district during the past week closed a contract with a valley furnace interest for 1,000 tons per month from April to April on sliding scale prices based on monthly averages. Bessemer pig iron for April and May is quoted at $23 valley furnace and for June $22.50 to $23 with basic at the same price. Northern No. 2 foundry iron is strong at $24.50 to $25 valley furnaces for prompt and second quarter, and $23.50 to $24 for third quarter and $22 for contracts running through the last half, although in some instances valley furnaces are already quoting $23 for third and fourth quarter or last half delivery. Southern No. 2 foundry for prompt delivery may be had at $22.50 Birmingham, and for last half $18.50 to $19 Birmingham. For second half delivery we quote as follows:

Bessemer, Valley	$22.50 to 23.00
Bessemer, Pittsburg	23.35 to 23.85
No. 1 Foundry, Pittsburg	24.35 to 24.85
No. 2 Foundry, Pittsburg	24.35 to 24.85
Gray Forge, Pittsburg	21.35 to 21.85
Basic, Valley	22.00 to 22.25
Basic, Pittsburg	22.85 to 23.10

Ferro-Manganese.—The market in this district has been quiet with very little business being done and a very light inquiry. For spot delivery on foreign 80 per cent ferro-manganese delivered in the Pittsburg district we quote $75 and for last half delivery $68 Pittsburg. Shortage of the higher grades of ferro-silicon in the eastern territory has created a strong demand for the lower grades. We quote imported 50 per cent ferro-silicon $110 Pittsburg. Domestic, 12 per cent, $36; 11 per cent, $35; 10 per cent, $34; with the lower grades of imported ferro-silicon $1 higher.

Steel.—The very heavy demands of finished mills for all classes of material, plates, shapes and bars, has created a marked scarcity for semi-finished material, and while Bessemer billets are quoted $29 to $29.50 Pittsburg, this price, if offered, would hardly bring out any material. The new 72-inch plate mill of the Carnegie Steel Co. at Homestead has not been operated to capacity on account of scarcity of steel, due to the heavy demands of other departments. Independent interests are in much the same shape and sellers of billets under ordinary conditions are out of the market and themselves running with an inadequate supply. We quote Bessemer billets 4 x 4 and larger, $29 to $29.50 Pittsburg, and open-hearth billets, $30.50 to $31. Sheet bars are quoted nominally at $30.

Merchant Bars.—The recent eastern stock flurries have had absolutely no influence on the specifications against standing contracts for merchant steel bars and full mill capacity is by far inadequate to supply the demands for shipment and the prorating plan has been resorted to in order to make equitable distribution to consumers. The committee appointed by the implement makers to ascertain the disposition of mills on the granting of a concession has not approached the large producers of merchant bars and no official announcement has therefore been made as to what they may expect. Bar iron, while prices are very strong, has been moving slowly during the past week. We quote 1.80c Pittsburg for delivery in this district, and

1.65c base Pittsburg, plus freight to point of delivery, for western shipment. Official quotations are as follows:

Common iron bars, 1.80c Pittsburg in carload lots and over; 1.85c in less than carloads; Bessemer steel bars, 1.60c, net; plow and cultivator, 1.60c, net; channels, angles, zees, tees, under three inches, 1.70c, all f. o. b. Pittsburg. The following differentials are maintained on steel: Less than 2,000 pounds, 0.10c advance; less than 1,000 pounds of a size, 0.30c advance. Cold rolled and ground shafting, 50 per cent off in carload lots, and 5 per cent off in less than carloads, delivered in base territory; open-hearth spring steel, 2.25c to 2.50c; sleigh shoe flats, 1.60c to 1.65c; smooth finished machinery steel, 1.90c to 2c; toe calk, 2.10c to 2.15c. The price of planished and machine straightened tire is 1.80c, base, half tire extras. Iron finished tire up to 1½ inch and over to be sold on regular bar basis of 1.60c base, half extras, steel card.

Muck Bar.—The market continues exceedingly quiet, as all of the large consumers are covered and producers have no tonnage to offer. Quotations remain nominal at $37.50 to $38.00 for pig metal bars and $36.75 for scrap bars.

Sheets.—New business has been very satisfactory during the past week and in considerable volume and specifications, exclusive of contracts, have been good. The leading interest as well as independent mills are running practically full to their sheet capacity and very few mills are in position to take any great advantage of premium business for quick deliveries on account of having taken on such large volumes of contract tonnage some time ago. Prices are unchanged as follows:

Black steel sheets one pass, cold rolled; Nos. 11-12, 2.20c; Nos. 13-14, 2.25c; Nos. 15-16, 2.30c; Nos. 17-21, 2.35c; Nos. 22-24, 2.40c; Nos. 25-26, 2.45c; No. 27, 2.50c; No. 28, 2.60c; No. 29, 2.75c; No. 30, 2.85c; galvanized, Nos. 10-11, 2.65c; Nos. 12-14, 2.75c; Nos. 15-16, 2.85c; Nos. 17-21, 3.00c; Nos. 22-24, 3.15c; Nos. 25-26, 3.35c; No. 27, 3.55c; No. 28, 3.75c; No. 29, 4.00c; No. 30, 4.25c. Corrugated roofing, $1.85 per square for No. 28 painted, 2½-inch corrugation, and $3.25 per square No. 28.

Plates.—Mills in this district are booked to capacity so far ahead that they will not accept further business for delivery short of August or September, and eastern mills that have been securing from $2 to $4 per ton premium are now filled up to an extent greater than they have been at any one period for several years and except in a few special instances are out of the market for deliveries short of two months even at advanced prices over the card schedule. Specifications against existing obligations are very heavy. The new 72-inch plate mill of the Carnegie Steel Co., at Homestead, has been tried out and is all ready to operate to capacity as soon as an adequate steel supply can be arranged for. We quote the following nominal official prices:

Tank plate, ¼-inch thick, 6½ to 100 inches, 1.70c f. o. b. mill Pittsburg. Light plate schedule, No. 10, 1.80c; Nos. 11-12, 1.85c; Nos. 13-14, 1.90c; Nos. 15-16, 2c; extras on the regular plate schedule are as follows per 100 pounds: Boiler and flange steel plates, 0.10c; A. B. M. A. and ordinary firebox steel plates, 0.20c; still bottom steel, 0.30c; marine steel 0.40c; locomotive firebox steel, 0.50c; all sketches, excepting straight taper plates varying not more than four inches in width at ends, narrowest end not being less than 30 inches, 0.10c; circles, 0.20c. Plates in width over 100 inches up to 110 inches, 0.05c; over 110 inches up to 115 inches, 0.10c; over 115 inches up to 120 inches, 0.15c; over 120 inches up to 125 inches, 0.25c; over 125 inches up to 130 inches, 0.50c; over 130 inches, 1.00c. Gages under ¼-inch to and including 3-16-inch plates on thin edges, 0.10c; under 3-16 to and including No. 8, 0.15c; under No. 8 and including No. 9, 0.25c. Five cents extra for less than carloads. Terms, net cash in 30 days.

Tin Plate.—New third quarter business has been very satisfactory and specifications against old contracts for earlier deliveries have been heavy. Lack of semi-finished material has caused suspension of operations at three small plants of the leading interest and other interests are handicapped to some extent for the same reason. We continue to quote as follows:

Coke tin plate, 100-pound basis, 14 x 20, $3.90 f. o. b. mill, Pittsburg district. Terms, 30 days, less two per cent for cash in ten days.

Hoops, Bands and Cotton Ties.—With April 1 there has been some new buying of hoops and bands, but the big April business is not expected much before the middle of the month and the large volume of the yearly contracts not before July. No announcement has been made regarding the opening of the cotton tie market, but a substantial increase in demand over last year is expected, and shipments to southern distributing centers are accordingly large. We quote:

Hoops in carload lots, 2c; in less than carload lots, 2.10c; bands, 1.60c base half extras as per standard steel.

Rails and Track Material.—The sales of standard rails during the week have been about 20,000 tons, mostly to steam roads. Appearances point toward a resumption on the part of the railroads in placing business and announcement has been made that practically all suspensions made since the beginning of the Wall street scare have again been placed on the books. These suspensions have been very small in comparison with the total business and the talk about these transactions created an erroneous impression. Actual conditions are such that mills cannot keep pace with the demand for ordinary replacements without seriously considering new construction work and extensions. The inquiry during the past week amounted to 60,000 tons, which is more than the combined inquiry of the preceding three weeks. We quote as follows:

Fifty-pound and heavier, 500-ton lots and over, $28; carloads and less than 500 tons, $30; less than carload lots, $32; 8-pound, $40; 12-pound, $36 to $37; 16-pound, $35 to $36; 20-pound, $34 to $35; 25 to 45-pound, $33 to $34; angle splice bars for standard sections, $1.65; spikes for forward deliveries, $2.50.

Wire and Wire Nails.—The volume of business is increasing over the enormously heavy business placed during the past four or five months and buyers are pressing mills for deliveries at a rate never before experienced, in addition to placing supplementary orders and taking out entire contract tonnages. Shortage of the proper kind of cars has delayed shipments to some extent, and, with adequate railroad service, shipments would be better. Prices are unchanged as follows:

Wire nails, jobbers' carload lots, $2; retailers' carload lots, $2.05; less than carloads, $2.10; painted barb wire, $2.15, for jobbers in carloads; retailers in carloads, $2.20; and less than carloads, $2.30 with 30c for galvanizing; plain wire, $1.85 for jobbers and $1.90 by carload.

Merchant Pipe.—Despite the action of the leading interest in withdrawing prices to shippers prior to June 1, the volume of business has not decreased to any appreciable extent and jobbers are taking their chances by placing business and expressing a willingness to pay whatever price the leading interest fixes or whatever delivery they can make at their own convenience after that date. Reports on stocks held by shippers are that they are very light and none of them are in position to take any great advantage of the present scarcity of material. Prices of merchant pipe out of stock range from 71

and five to 74 and five, the latter being the nominal extreme mill discount, although it cannot be accepted as a basis for quotations. Wrought iron pipe is quoted nominally at 68 off the card on base sizes to consumers and one point higher to jobbers. We quote the following nominal prices to consumers, the card allowing one point higher discount to jobbers:

	—Steel—	
	black.	galv.
⅛ to ¼ inch	65	49
⅜ inch	67	53
½ inch	69	57
¾ to 6 inches	73	63
7 to 12 inches	68	53
EXTRA STRONG PLAIN ENDS.		
⅛ to ¼ inch	58	46
⅜ to 4 inches	65	53
4½ to 8 inches	61	49
Double extra strong plain ends, ½ to 8 inches	54	43

Old Material.—The quiet condition of this market still continues with wavering tendency toward lower prices, but this is not to any great extent and there is no pronounced bear movement anticipated, although it would not be surprising to see a drop of 50 to 75 cents a ton all along the line. Dealers have begun to appreciate they cannot secure the present high prices being quoted and are disposed to let go of their holdings. Consumers have shown no inclination to buy and their stock sheds are practically full. Turnings are still active in the east, but not to the extent they were two weeks ago. For prompt shipment, delivery in the Pittsburg district, we quote:

Heavy melting scrap, $18 to $18.50; re-rolling rails, $19 to $19.50; bundled sheet scrap, $16.50 to $16.75; iron axles, $30.50 to $31; old iron rails $23 to $23.50; No. 1 wrought scrap, $19 to $19.25; old car wheels, $24.50 to $24.75; low phosphorus scrap, $22.50 to $23; machine shop turnings, $15.75 to $16.25; axle turnings, $16.50 to $17; cast borings, $13.50 to $13.75; No. 1 cast scrap, $20.50 to $21.

Coke.—The stocks of coke at the ovens in the Connellsville region accumulated during the flood, when shipments on account of inadequate railroad facilities tied up the region, are about cleaned up and the large quantity of low grade coke unloaded on the market is one of the causes to which the drop in prices is attributed. Several furnace operations which have had their coke shipments suspended on account of repairs are again taking their full supply and furnace coke is reasonably strong in price, and we quote $2.85 to $2.90 at the ovens. Foundry coke is not so strong as it was last week and for spot shipment or delivery before July 1 we quote $3.50 to $3.60, and for delivery through the remainder of the year or last half, $3.50.

CHICAGO

Specifications Are Heaviest on Record —Pig Iron Is Quiet.

Office of THE IRON TRADE REVIEW.
1362 Monadnock Block, April 2.

Except for a continued heavy volume of specifications for all kinds of finished material, there is nothing of particular interest to chronicle this week. Pig iron is quiet and scrap is weak, but neither more so than is expected for this time of the year. Some large transactions in old material were concluded a few days ago, two local steel interests purchasing an aggregate of 8,000 tons of old steel rails and a third melter buying about 6,000 tons of heavy melting steel stock. Cast scrap has increased in strength in sympathy with pig iron, and car wheels are again quoted at $25 Chicago. Specifications on local mills are the heaviest in history. Plate, sheet, wire and steel bar mills are so tightly filled that several are practically out of the market on new tonnage for the remainder of the year. Implement manufacturers are slowly coming into the market for steel bar tonnages, but are covering for only six months' requirements. Tubular goods are very active, the most important contracts pending being for 5,000 tons of cast iron pipe for Salt Lake City, and 12,000 tons for the city of Chicago.

Pig Iron.—The only development of interest affecting southern iron is the announcement that commencing April 1 the freight rate between Birmingham and the Ohio river, takes the 25-cent advance that was postponed for two months, increasing the through rate to Chicago to $4.35. This rate will apply on all shipments on and after that date. Very little inquiry has been felt for iron in the past week. A few scattering sales for all deliveries have been made. Notably one lot of 1,000 tons of basic at $19 Birmingham and 1,800 tons of No. 2 foundry at $18 Birmingham, both for the last half. Since the warm weather set in, the movement of iron from southern yards has been very brisk, one local office having bills of lading for one day's shipments from its Birmingham furnaces for a total of 750 tons. A railroad official in touch with the situation at Birmingham puts the tonnage moved during the two months in which the proposed 25-cent freight rate advance was held in abeyance at 300,000. It is stated that there are less than 30,000 tons of iron on southern yards at the present time, and that this will be moved in a short time if the present splendid car supply is maintained. This improved movement naturally has resulted in a sharp decline for spot and second quarter iron, and sympathetically second half has also suffered. The range of prices remains unchanged, however, at $22.50 to $23 Birmingham for spot; $21 to $21.50 Birmingham for May and June and from $18 to $19 for the last half. The demand for northern irons is even lighter than for southern grades, the largest transaction of the week involving only 500 tons. This was for spot delivery and was sold on the basis of $26.60 Chicago. Some English and Scotch irons have been sold here within the past week for immediate shipment at $28 to $28.50 Chicago. The old stack of the Harvester company went out of blast last week for relining. This makes four local furnaces now idle. Our prices on southern iron have been raised 25 cents a ton to provide for the freight advance, otherwise there is no change. We quote as follows:

Lake Superior charcoal	$25.50 to 26.50
Northern Foundry No. 1	24.00 to 24.50
Northern Foundry No. 2	23.50 to 24.00
Northern Foundry No. 3	23.00 to 23.50
Northern Scotch Foundry	24.00 to 24.50
Ohio Strong Softeners No. 1	23.30 to 23.80
Ohio Strong Softeners No. 2	22.80 to 23.30
Southern Foundry No. 1	22.85 to 23.35
Southern Foundry No. 2	22.35 to 22.85
Southern Foundry No. 3	21.85 to 22.35
Southern Foundry No. 4	21.35 to 21.85
Southern No. 1 Soft	22.85 to 23.35
Southern No. 2 Soft	22.35 to 22.85
Southern Gray Forge	20.35 to 20.85
Southern Mottled	19.85 to 21.35
Southern Silveries, 4 per cent to 6 per cent Silicon	23.85 to 24.85
Jackson Co. Silveries, 8 to 10 per cent Silicon	30.30 to 32.30
Malleable Bessemer	23.50 to 24.00

Billets and Rods.—Demand for crude steel is undiminished. Not all the tonnage offered mills is accepted, as satisfactory deliveries can be given on only a small proportion. The market remains firm at $36 to $38, Chicago, for forging billets, and from $35 to $36, Pittsburg, for Bessemer rods.

Iron and Steel Bars.—Contracting for steel bars for deliveries extending over the second half of the current year is increasing. No large amounts have been placed, but the aggregate tonnage let is of good proportions. Inquiries are numerous, the majority being for six months' wants. This tendency indicates a determination upon the part of the implement people to withhold a portion of their tonnage in anticipation of a lower market prevailing around Jan. 1. Bar iron enjoys a brisk movement and is firmly maintained on the basis of 1.65c Pittsburg. We quote as follows:

Soft steel bars and bands, 1.76½c, half extras; soft steel angles less than 3 x 3, 1.86½c; hoops, 2.16½c base, full extras. We quote bar iron from stock, 2.25c; full extras; soft steel rounds and squares, 3 inches and larger, $2 per 100 pounds base; flats, 2 inches to 4 inches by 1⅛ inch and larger, $2 per 100 pounds base; 4½ inches x 5 inches and 6 inches x 5-16 inch and thicker, $2 per 100 pounds base; all ovals, half rounds, $2 per 100 pounds base; steel bands,

$2, half extras; soft steel hoops, 2.40c to 2.50c full extras. Other sizes not mentioned above, $2 per 100 pounds base plus half extras.

Plates.—The congestion on local mills' books is unrelieved. Specifications are the heaviest in history, and the best delivery obtainable on new tonnage is four months. Outside mills are taking a lot of business in this market for quick shipment, for which they are securing premiums of $2 to $3 a ton. Jobbers are also overwhelmed with orders, and are experiencing trouble in replenishing broken lines. Prices are very firm. We quote as follows:

Plates ¼ inch and thicker 6⅛ to 100 inches wide, either universal or sheared, 1.70c Pittsburg base. For extras, see Pittsburg report. Freight rate to Chicago, 16½c per 100 pounds. Jobbers' prices for shipment from local stocks are as follows: Tank steel ¼ inch and heavier up to 72 inches wide, 2.20c; 3-16 inch up to and including 60 inches wide, 2.30c; 3-16 inch 72 inches wide, 2.55c; No. 8 up to 60 inches wide, 2.35c. Flange steel, 25c extra; heads, 25c extra.

Sheets.—New tonnage continues to accumulate on mill books, despite the already overwhelmingly sold condition of most producers. Demand for galvanized sheets is by far the heaviest, the leading interest being sold up completely for twenty-five weeks. Local jobbers are getting fancy prices for the heavier gages of this material. Stocks are low, and deliveries very slow. We quote carload lots, as follows:

Black sheets Nos. 8, 9, and 10, 1.90c Pittsburg; No. 28 gage, 2.60c Pittsburg. Galvanized sheets No. 28 gage, 3.75c Pittsburg. Freight to Chicago 16½c per 100 pounds. Jobbers' prices on less than carload lots from store are as follows: No. 10, 2.25c to 2.30c; No. 12, 2.30c to 2.35c; No. 14, 2.35c to 2.40c; No. 16, 2.45c to 2.50c; Nos. 18-20, 2.70c to 2.80c; Nos. 22-24, 2.75c to 2.85c; No. 26, 2.80c to 2.90c; No. 27, 2.85c to 2.95c; No. 28, 2.95c to 3.05c; No. 30, 3.35c. Galvanized sheets, Nos. 10 to 20, 3.40c to 3.45c; Nos. 22 and 24, 3.55c to 3.60c; No. 26, 3.75c to 3.80c; No. 27, 3.95c to 4c; No. 28, 4.15c to 4.20c; No. 30, 5.35c to 5.40c.

Structural Steel.—A gratifying increase is noted in the demand for structural shapes. Jobbers and fabricators are specifying more freely than before, while car builders and railroad interests are taking all the material they can get. No building contracts of particular moment have been closed in the past week in this city, though several are nearing the closing stage. Prices are without change as follows:

Beams and channels, 3 to 15 inches inclusive, 1.70c Pittsburg. For extras see Pittsburg report. Freight rate from that city to Chicago is 16½c per 100 pounds. Quotations from stores are as follows:

All angles, three inches and larger, including six inches, $2.05 to $2.10 per 100 pounds; angles over six inches, $2.15 per 100 pounds base, beams, three inches to 15 inches, inclusive, $2.05 to $2.10 per 100 pounds base; channels, three inches and larger, $2.05 per 100 pounds base. Less than carload lots are $1 a ton higher than foregoing prices.

Rails and Track Supplies.—Traction enterprises are the source of the current inquiries for rails and track supplies. Some large projects are under consideration, notably an interurban line to connect Chicago and Kansas City, but it is extremely problematical when these will reach the stage when rails will be wanted. Nevertheless, the aggregate tonnage of rails placed is considerable, in comparison with the small amount available. Prices are without change, as follows:

Bessemer rails, $28 to $30; less than 500-ton lots, $32; open-hearth rails, $29; light rails, Bessemer, 30 to 45-pound sections, $35; 25-pound, $36, 20-pound, $37, 16-pound, $38, 12-pound, $39, and lighter sections down to 8-pound, $45.50, all f. o. b. mill. Track supplies vary in price according to quantity and delivery. Angle bars in large lots are quoted 1.65c to 1.75c; for smaller quantities, 2.25c to 2.75c; spikes, large lots, 2.40c; for smaller quantities, 2.60c; bolts, large lots, 2.75c; smaller lots, 2.85c with square nuts, and 3c with hexagon nuts.

Merchant Steel.—Manufacturers report a number of six-months' contracts from implement sources. Buyers are contracting slowly for these wants, the tendency being to cover only for nearby requirements at the present time. Prices are firmly maintained as follows:

Planished or smooth finished tire steel, 1.96½c; iron finish, up to 1½ x ½ inch, 1.91½c base; iron finish, 1½ x ½ inch and larger, 1.76½c base; channels for solid rubber tires, ¾ to 1 inch, 2.26½c, and 1⅛ inch and larger, 2.16½c; smooth finished machinery steel, 2.16½c; flat sleigh shoe, 1.81½c; concave and convex sleigh shoe, 2.06½c; cutter shoe, 2.35c; toe calk steel, 2.31½c; railway spring, 1.96½c; crucible tool steel, 6½c to 8c, with higher prices asked on special grades. Shafting is very strong. Quotations are without change at 50 per cent off in car lots and 45 per cent in less than car lots in base territory.

Cast Iron Pipe.—The only contracts of importance pending are those of Salt Lake City, Utah, for 5,000 tons; and the city of Chicago for 12,000 tons. The latter is very likely to be cut in two on the day of letting. The market continues very firm, a large number of inquiries for small lots pending. Prices are without change as follows: Four-inch water pipe, $38.60; six to 12-inch, inclusive, $37.60; 16-inch and upward, $36.60; gas pipe, $1 a ton higher.

Merchant Pipe and Boiler Tubes.—Independent manufacturers and jobbers are experiencing an active demand for pipe and tubes since the withdrawal from the market of the leading producer. The open weather that has prevailed throughout the west has developed an unusually heavy consumption of these products, and to be sure of deliveries it behooves consumers to place their orders early. The following prices are those of a large independent maker, and are on the basis of Pittsburg delivery: Random lengths with thread couplings, ⅛ and ¼ inch, 65 per cent discount off for black and 49 per cent off for galvanized; ¾ inch to 6 inches, 73 per cent off for black and 63 per cent off for galvanized; 7 to 12 inches are quoted at 68 and 53, respectively. Extra strong plain ends are held at 58 off for black and 46 off for galvanized, in sizes from ⅛ to ⅜ inches, and at 6 and 49 respectively for 4½ to 8 inches.

Chicago jobbers are quoting 70 off for black steel pipe, ¾ to 6 inch, and iron pipe at four to five points higher. Tubes are unchanged at 60 off for steel, and 47½ off for iron and seamless.

Wire Products.—No cessation in the volume of business is noted. An unusual acceleration of orders has followed the warm weather of the last two weeks and manufacturers are overwhelmed with orders. Many jobbers had allowed their stocks to get low in the belief that prices might be lower, and the sudden jump from wintry to summer-like conditions caught a goodly number of these unprepared for the change. Shipments of galvanized material are the slowest, mills moving easily on these because of the high cost of galvanizing materials. Prices are without change, and we quote to jobbers, Chicago delivery, as follows:

Wire nails, $2.15; painted barb wire, $2.30; galvanized barbed wire, $2.60; smooth annealed wire, $2.30; polished staples, $2.55. Carload lots to retailers, five cents higher; less than carload lots, 15 cents higher.

Coke.—No noticeable change is observed either in the spirit or letter of the local market. Demand is fair, but with the improvement of shipping conditions in Connellsville regions, there is less call for spot fuel. Prices for foundry coke are unchanged at $3.50 to $3.60 ovens for forward deliveries, and $3.60 to $3.75 for immediate shipment. Solvay coke for nearby deliveries ranges from $6.50 to $6.75 Chicago.

Old Material.—Mill scrap is in a "wobbly" condition. The large tonnage thrown on to this market in the last few weeks by agricultural dealers combined with the overstocked condition of local merchants and mills, has driven out what little strength these grades had. With country roads rapidly drying up, the natural expectation is that shipments from these sources will increase as spring lengthens into summer; and a long period of weakness is looked for. Steel scrap of all kinds has also slumped off since the International Harvester Co., Inland Steel Co. and Grand Crossing Tack Co. filled their wants recently. The two first mentioned concerns bought in the aggregate 8,000 tons of old steel rails, 3 feet and under, at an average price of $18.50, Chicago, while the Grand Crossing interest took in the neighborhood of 6,000 tons of heavy melting stock. Cast scrap is the only active product on the list. Four hundred tons of car wheels were disposed of a week ago by the Burlington road at $25 Chicago, and this price is the minimum quotation ruling today. Both No. 1 cast and stove plate are firm at the prices given below. We have revised our prices, and quote gross tons in the first paragraph as follows:

Old Steel Rails (3 feet and over)	$18.00 to 18.50
Old Steel Rails (less than 3 feet)	17.00 to 17.50
Old Car Wheels	25.00 to 25.25
Old Iron Rails	24.00 to 24.50
Light Section Relayers, 45 lbs. and under, subject to inspection	30.00 to 32.00
Relaying Rails, subject to inspection	31.00 to 31.50
Frogs, Switches and Guards	16.50 to 17.00
Heavy Melting Steel	16.00 to 16.50
Mixed Country Steel	12.50 to 13.00

We quote net tons as follows:

No. 1 R. R. Wrought	$15.00 to 15.50
No. 2 R. R. Wrought	14.00 to 14.50
Shafting	17.00 to 17.50
Dealers Forge No. 1	12.00 to 12.50
Wrought Pipe and Flues	12.00 to 12.50
No. 1 Cast, 150 lbs. and less	19.00 to 20.00
No. 1 Mill	10.00 to 10.50
Mixed Busheling (No. 1 & No. 2)	11.00 to 11.50
Country Sheet	8.50 to 9.00
No. 1 Boilers Cut	11.50 to 12.00
Boiler Punchings	15.00 to 16.00
Cast Borings	9.25 to 9.75
Mixed Borings, etc	9.00 to 9.50
Machine Shop Turnings	11.50 to 12.00
Railroad Malleable	16.00 to 16.50
Agricultural Malleable	15.50 to 16.00
Stove Plate and Light Cast Scrap	15.50 to 16.00
Old Iron Splice Bars	19.50 to 20.00

CINCINNATI.

Pig Iron Market Dull and Buyers Hesitate to Contract for Last Half.

April 2.

Pig Iron.—The market in a general way continues dull. There are a few fair-sized inquiries, however, which are being figured on. One calls for about 2,800 tons of foundry iron, one for between 3,000 and 4,000 tons for third quarter delivery, another for 2,000 tons in the last half of the year, and another large melter is asking for prices without specifications as to tonnage. Aside from these inquiries the market rules quiet. Deliveries on contracts for southern iron have made decided improvement in the last ten days, and this has caused an easier feeling for spot iron and some concessions in prices have been made. The advance in freight rates from the south took effect today as published and quotations are revised to conform to the new figures. We quote spot iron as a basis for settling contracts based on our quotations as follows, delivered Cincinnati:

Southern foundry No. 1,	$26.25 to 26.75
Southern foundry No. 2,	25.75 to 26.25
Southern foundry No. 3,	24.75 to 25.25
Southern foundry No. 4,	23.25 to 23.75
Southern foundry, No. 1 soft	26.25 to 26.75
Southern foundry, No. 2 soft	25.75 to 26.25
Gray forge	21.75 to 22.25
Northern foundry No. 1	26.65 to 27.75
Northern foundry No. 2	26.15 to 27.15
Northern foundry No. 3	25.65 to 26.65
Jackson County silvery, 8 per cent	31.15

For second quarter delivery southern iron is obtainable at $21.00 Birmingham, with some furnaces seeking $21.50. In southern Ohio, iron for second quarter is scarce and merely nominal at $23.00 at furnace with practically none offered.

For third quarter there is an increasing tendency to ask $19.00 for southern No. 2, although on contracts running through the last half $18.50 is still the going price. Reports from southern furnaces are all strong in tone and several large producers are demanding $19.00 for the last half.

Buyers are less inclined as a rule to place orders for forward delivery than they were. Probably the improvement in deliveries on old contracts at prices lower than now prevail is having an influence in causing them to defer making new contracts. The situation admits of a prolonged waiting period, as buyers are well covered until July and furnaces are booked up far ahead and can maintain prices without piling iron for some time to come. We quote for last half delivery, delivered Cincinnati, as follows:

Southern Foundry No. 1	$22.25 to 22.75
Southern Foundry No. 2	21.75 to 22.25
Southern Foundry No. 3	21.25 to 21.75
Southern Foundry No. 4	20.75 to 21.25
Southern Foundry No. 1 soft	22.25 to 22.75
Southern Foundry No. 2 soft	21.75 to 22.25
Gray Forge	19.75 to 20.75
Northern Foundry No. 1	22.65 to 23.15
Northern Foundry No. 2	22.15 to 22.65
Northern Foundry No. 3	21.65 to 22.15
Jackson County Silvery, 8 per cent	30.15 to 31.15

Finished Material.—The jobbing demand in a retail way continues good and the market is firm here for small orders. Specifications on contracts are satisfactory. Retail orders are filled here at the following quotations:

Angles, 3 x 3 and over, 2.15c to 2.25c; beams and channels, 15 inches and under, 2.15c; small angles and architectural channels, 2.10c base; plates ¼ inch and heavier, 2.10c; 3-16 inch, 2.20c; No. 8, 2.20c; sheets (blue annealed) No. 10, 2.30c; No. 12, 2.35c; No. 14, 2.40c; No. 16, 2.50c; box annealed sheets, Nos. 18 and 20, 2.65c; Nos. 22 and 24, 2.75c; Nos. 25 and 26, 2.80c; No. 27, 2.85c; and No. 28, 2.95c. Iron and steel bars, 2.00c base; boiler tubes, 60 per cent off base; turn buckles, 45 per cent off; rivets, 3.15c base; cold rolled shafting, 45 per cent off list; steel tire, 2.10c base.

Coke.—The market is easy and inside prices are freely done. There is not much being done in the way of contracting. The only element of strength in the market is the reported desertion of labor from the coke fields and the probable curtailment of output from now on and especially during the summer months. Prices in the leading coke producing districts are as follows:

Wise County, Va., Furnace Coke, prompt shipment	$3.00 to 3.25 per ton
Wise County, Va., Foundry Coke	3.75 to 4.00 per ton
Pocahontas Furnace Coke, prompt shipment	3.00 to 3.25 per ton
Pocahontas Foundry Coke	3.50 to 4.00 per ton
Connellsville Furnace Coke, prompt shipment	3.00 to 3.50 per ton
Connellsville Foundry Coke	3.75 to 4.00 per ton
New River Foundry Coke on contracts	3.75 to 4.00 per ton
New River Furnace Coke, prompt shipment	2.75 to 3.00 per ton

*Wise County, Va., Coke on Furnace contracts is sold mainly on a sliding scale basis for pig iron prices on the following basis: $1.70 to $1.75 per ton on $9.00 pig iron, plus 19 to 20 per cent of the advance on pig iron above $9.00 Birmingham.

Old Material.—While the market is quiet, dealers are firm in their views and quotations are without change. We quote, f. o. b. Cincinnati, as follows:

Old No. 1 railroad wrought, net tons	$17.50 to 18.50
Cast machine and foundry, net tons	19.00 to 19.50
Old iron rails, gross tons	25.50 to 26.50
Old steel rails, gross tons	19.00 to 20.00
Old short lengths, gross tons	19.00 to 20.00
Old iron axles, net tons	26.00 to 26.50
Heavy melting scrap, gross tons	20.00 to 21.00
Stove plate, net tons	15.50 to 16.00
Wrought turnings, net tons	13.50 to 14.00
Cast borings, net tons	11.00 to 11.50
Car wheels, gross tons	23.50 to 24.00

CLEVELAND.

Heavy Sales of Steel Bars.—Pig Iron Market is Quiet.

Office of THE IRON TRADE REVIEW.
Browning Building, April 2

Iron Ore.—Two vessels left Lake Erie ports April 1, bound for Duluth. It is not yet possible to pass through the locks at the Soo and the date of arrival of these vessels at their destination is uncertain. It is not expected that the opening of navigation will really take place before April 15. Ore

is not yet being received at the upper lake docks.

Pig Iron.—The market has been very quiet during the past week, buyers being slow to contract for last half delivery and furnaces are showing a disposition not to sell for the third quarter, as they are encouraging buyers to contract for the whole of the last half of the year. There is a good demand for spot foundry iron, which can now be obtained at $24 Cleveland, as a fair tonnage has appeared from unexpected sources, the explanation being that the production of the furnaces was larger than anticipated. Although the leading interests in the south are firmly adhering to their quotations, $18.50 being the minimum for No. 2 Birmingham, the $18 quotation among smaller interests is still heard. Local furnaces have sold their product through the third quarter and are asking $22 furnace for No. 2 for the fourth quarter. We quote, f. o. b. Cleveland for last half delivery, as follows:

Bessemer	$21.00 to 21.50
No. 1 Foundry	22.50
No. 2 Foundry	22.00
No. 3 Foundry	21.50
No. 2 Southern	22.60
Gray Forge	20.00 to 20.50

Coke.—The market is not active and the supply appears to be fully equal to the demand. For the remainder of the year, we quote furnace coke at $2.90 ovens and foundry at $3.50 to $3.60.

Finished Material.—Leading interests have sold steel bars for last half delivery amounting to 20,000 tons during the week, and the outlook for further buying is good. Agricultural interests have not been in the market in this district. There is an active demand for hoops and bands. Bar iron shows some irregularity but local mills are well supplied with orders, specifications continually exceeding production. It is impossible to obtain prompt delivery of sheets, especially blue annealed without paying high premiums. The demand for structural shapes shows further improvement.

Old Material.—Conditions generally remain the same in the old material market. Some grades are quite strong while others are stationary. The demand continues for turnings and borings. These grades have become exceedingly scarce and dealers are having difficulty in obtaining them. Cast scrap, stove plate and car wheels are also strong. There is more demand for busheling, but wrought iron is weak. The Lake Shore railroad has closed on a list of 3,000 tons and the Pennsylvania and Big Four lines have their monthly lists of 3,000 and 5,000 tons respectively, in the market. We have revised our quotations and quote, f. o. b. Cleveland, gross tons, as follows:

Old iron rails	$25.00 to 26.00
Old steel rails (re-rolling)	18.00 to 19.00
Old steel rails (under 6 feet)	18.50 to 19.50
Old car wheels	23.00 to 23.50
Steel boiler plate	14.00 to 14.50
Steel axles	21.50 to 22.50
Malleable iron (railroad)	18.50 to 19.00
Malleable iron (agricultural)	16.50 to 17.00
Heavy steel	17.00 to 17.50
Country mixed steel	14.50 to 15.50
Low phosphorus	22.50 to 23.50

We quote net tons as follows:

No. 1 R. R. wrought	$16.50 to 17.50
No. 1 busheling	14.50 to 15.00
No. 1 machine cast	18.00 to 19.00
Iron axles	25.50 to 26.00
Axle turnings	14.00 to 14.50
Wrought turnings (free from cast)	13.00 to 13.50
Grate bars	14.00 to 15.00
Pipes and flues	13.50 to 14.00
Tank iron	12.00 to 13.00
Hoop and band iron	8.50 to 9.00
Sheet iron	7.50 to 8.50
Wrought drillings	13.00 to 13.50
Stove plate	15.00 to 15.50
Cast borings	10.75 to 11.25

PHILADELPHIA.

Interest in the Last Half.—Easier Conditions in Finished Lines.

April 2.

Pig Iron.—Now that the second quarter is here and no let-up in sight for spot or prompt shipments, which still command high prices because of the scarcity of such iron, interest is being gradually transferred to the last half of the year. Most furnaces in eastern territory are pretty well sold up for the third quarter, but the last quarter remains a mystery which exerts a more or less retarding effect on prices. So much has been written and said about the prospects of a slump, either gradual or sudden, in the trade after October that both sellers and consumers are very wary about prices for that period, and the covering of requirements for that quarter is generally made under orders for the whole last half. Some furnaces will not accept orders for the third quarter unless some commitment is made for the fourth quarter also. This position is by no means universal, however, and as a result last half quotations show a pretty wide range, somewhat below that for the third quarter. The greatly improved conditions in Wall street and the report from Pittsburg of renewed strength there are encouraging factors, and the market for the second quarter shows great strength. Considerable Middlesboro iron has been bought for May delivery here if the market remains as it is, and in the meantime all cargoes arriving find a ready sale at $21.50 to $22.00 for No. 3 in dock. Prices for the last half, subject to the peculiar conditions already mentioned, may be quoted about as follows:

No. 1X Foundry	$25.00 to 25.50
No. 2X Foundry	23.50 to 24.50
No. 2 Plain	23.00 to 23.50
Standard Gray Forge	22.25 to 22.75
Basic	23.75 to 24.50
Low Phosphorus	27.00 to 27.50

New Material.—There is a somewhat easier tone in the market for finished products, and deliveries are reported as being better than for some time. This does not mean that the mills have not plenty to do, but indicates that with their greatly increased capacity, they are gradually catching up with orders. Prices remain unchanged, as follows:

Beams, channels and angles, according to specifications, 1.83½c to 2c; refined iron bars, 1.89½c to 1.93½c; steel bars, 1.83½c to 1.88½c; plates, 2.13½c to 2.18½c.

Old Material.—The market for scrap is a little off under the combined influences of offerings by special line dealers and heavier collections by small dealers. The mills, though universally busy, have also been holding back in orders, claiming that prices are too high. The result has been a number of declines, and prices may be quoted as follows:

Old steel rails	$19.00 to 19.50
No. 1 steel scrap	18.25 to 18.75
Old steel axles	22.00 to 22.50
Old iron axles	29.00 to 30.00
Old iron rails	26.50 to 27.00
Old car wheels	23.00 to 24.00
Choice scrap R. R. No. 1 wrought	20.25 to 20.75
No. 1 yard scrap	18.50 to 19.00
Machinery scrap	22.50 to 23.00
Low phosphorus scrap	22.50 to 23.00
Wrought iron pipe	16.50 to 17.00
No. 1 forge fire scrap	16.75 to 17.25
No. 2 forge fire scrap, ordinary	11.50 to 12.00
Wrought turnings	16.50 to 17.00
Axle turnings, heavy	17.25 to 17.75
Cast borings	16.00 to 16.50
Stove plates	17.00 to 17.50

NEW YORK.

Satisfactory March Sales of Pig.—Heavy Bookings of Structural Shapes.

Office of THE IRON TRADE REVIEW.
Room 1315, No. 150 Nassau St., April 2

Pig Iron.—Furnaces throughout the eastern district enter the second quarter with their output sold, on an average, between five and five and one-half months ahead, or until well past the first of September. This fact comes as the result of a careful canvass among a large number of producers. It does not mean that there is no early delivery iron to be had, nor that furnaces generally have sold practically their entire output through the third quarter, but sets up the quite extensive selling of irons for last quarter shipment against tonnages remaining unsold for early delivery and arrives at an average in that way. Though its closing days were exceedingly quiet, March was a very fair month for sellers in point of tonnage placed, for in addition to the usual run of small business there were several

sales of good sized lots. One large interest reports a very heavy increase in sales as compared with those of March, 1906. During the past week new inquiry has been only moderate, though the International Harvester Co. is understood to have entered the market for a round tonnage. In addition to the 11,000 tons for its Schenectady plant, placed with Buffalo furnaces and previously reported, the General Electric Co. has closed for about 4,500 tons for its Lynn works, the order being divided among other interests. Another consumer which inquired for a fair tonnage to protect itself on early shipment iron withdrew from the market on the assurances of its regular sources of supply that its needs would be cared for. Some high prices are ruling for quick delivery iron, a sale of 500 tons of No. 2X at $25 furnace being reported for the second quarter. A lot of 400 tons No. 2 foundry for third quarter delivery sold at $22.50, Pennsylvania furnace. The advance in freight rates on pig iron from southern points, after several postponements, is finally effective, though it is claimed that railways serving that district are about three months behind in deliveries and accumulations in southern furnace yards have decreased but little. We quote, tidewater prices for second half delivery as follows:

Northern Foundry No. 1	$24.00 to 25.00
No. 2 Foundry	23.50 to 24.50
No. 2 Plain	23.00 to 24.00
No. 1 Southern Foundry	22.50 to 23.00
No. 2 Southern Foundry	22.00 to 23.00
No. 3 Southern Foundry	21.50 to 22.00
No. 4 Southern Foundry	21.00 to 22.00

Finished Material.—The aggregate of March bookings in structural materials was about 100,000 tons, of which 40,000 tons went to the American Bridge Co. That interest has taken about 7,000 tons for Pacific coast extensions of the St. Paul railroad which has closed with the Pennsylvania Steel Co. for 6,000 tons for a bridge over the Columbia and 9,000 tons for other structural and bridge work, dividing about 4,000 tons among several other concerns. About 2,500 tons for Erie bridges has been placed with the American Bridge Co., which has also secured about 3,000 tons for Salt Lake City buildings.

In the New York district considerable bridge work is pending for the Lehigh Valley and New York Central railways, for bridge construction, and about 6,000 tons of steel will be required for the Hudson county viaduct, Jersey City, for which bids will close April 4. In plates new business is not heavy, though specifications have been very large of late in order to work out contracts expiring with March. In few instances was any tonnage allowed to remain unspecified for. Considerable of the new business developing is of the kind demanding early shipment and good sized premiums are freely paid. A lot of 2,000 tons of quarter inch plate for the construction of pipe to be used in California was sought by certain eastern producers, but was taken by a Pacific coast concern. Locally the cast iron pipe market is inactive. Indications are that requirements of the coming season will be heavy, but the demand must come largely from municipalities and they are notoriously short-sighted in placing orders and may expect long delays in delivery. Bar iron prices were recently reaffirmed; the market is quiet.

Old Material.—In practically all lines the demand is good and the market is vigorous in the face of the evident facts that stocks are not extensive. Some very considerable sales of heavy melting steel are reported. We quote New York delivery, gross tons, as follows:

Old iron rails	$24.00 to 25.00
Old steel rails, long lengths	19.00 to 19.50
Old steel rails, short pieces	16.50 to 17.00
Relaying rails	28.00 to 29.00
Old car wheels	22.00 to 23.00
Old iron car axles	28.50 to 29.50
Old steel car axles	21.00 to 21.50
Heavy melting steel scrap	16.50 to 17.00
No. 1 railroad wrought scrap	19.50 to 20.00
Iron track scrap	17.50 to 18.00
Wrought pipe	14.50 to 15.00
Cast borings	12.50 to 13.00
Wrought turnings	14.75 to 15.25
Heavy cast scrap	19.50 to 20.00
Railroad malleable	19.50 to 20.50
Agricultural malleable	14.50 to 15.00
Stove plate	16.00 to 16.50
Grate bars	14.50 to 15.00

BUFFALO.

Demand for Spot Iron Strong.—Furnaces Can Not Meet Demand.

April 2.

Pig Iron.—The market has assumed a decidedly stiff tone in this territory this week and inquiries for early deliveries are more numerous. There is a very strong call for spot and the furnaces are seeking even small quantities from outside sources to meet the requirements of their customers, who are alarmed over present conditions. No prompt delivery orders have been accepted the past week, but in some quarters a few spot orders of a small amount may be filled soon.

Locally the conditions are of a strenuous character and it is feared that many consumers will be obliged to go short for some time to come. Another embarrassing feature is the fact that no foreign iron could be had for local consumption. The difficulty in getting valley iron here at present through the delays in shipping also adds to the troubles of manufacturers. To meet their needs, however, everything possible is being done.

Prices remain unchanged and it is not the custom of local furnaces to take advantage of the scarcity of iron to boost prices. Of course, if the demand assumes an alarming character and no iron can be had in large quantities, there may be a change in prices, but it is felt here that prices will stand firm at their present quotations unless a material change occurs in the market.

For Birmingham iron for last half, the price is $18.50 at furnace. There has been some selling for third and fourth quarter deliveries, but the buying is not general at this time, attention being made to the prompt iron market in an effort to care for the regular trade. For the last half delivery we quote as follows:

No. 1X Foundry	$22.75 to 23.25
No. 2X Foundry	22.25 to 22.75
No. 3 Foundry	21.50 to 22.00
No. 2 Plain	22.00 to 22.50
Malleable Bessemer	22.50 to 23.00
Gray Forge	21.50 to 22.00
Charcoal	26.00 to 27.00

ST. LOUIS.

Molders Threaten to Strike.—Southern Delivery is Improved.

April 1.

There was considerable agitation last week among the molders for higher wages and it was intimated there would be a strike today unless the foundries granted their demands. The stove interests were the first people to settle with their molders and all the agitation is over with them. It is reported that the molders in the machinery shops will go out unless they get an advance, but the foundries place little credence in the threat. Today none of the molders are out in St. Louis, but strikes are reported at Houston, Tex., Rock Island and Moline, Ill.

Pig Iron.—Quiet still reigns in the pig iron market for all deliveries. The threatened railway strike, which if continued long, would certainly paralyze all industries in the west, is having a tendency to cause melters to wait till the result is definitely known.

Interest is confined largely to the last half. Deliveries are considerably improved from the south and this is supplying almost enough iron for immediate consumption, so that spot is not in such great demand. There are enough orders however to maintain the price at $22.50 to $23 for southern No. 2. Second quarter is quoted at $21 to $22, and last half is even firmer at $18.50. One house reports selling last half at $18.50 and then having to raise to $19 on orders from the fur-

nace with the result that the buyers agreed to the advance.

Malleable Bessemer is scarce and in demand at $21 for second half. The new freight rate advance, which had been suspended sixty days, went into effect today.

Our quotations, including the freight rate of $3.75 from Birmingham, range as follows:

Southern No. 1	$22.25 to 22.75
Southern No. 2	21.75 to 22.25
Southern No. 3	21.25 to 21.75
Southern No. 4	20.75 to 21.25
Gray Forge	19.75 to 20.25

Finished Material.—The contract for the steel in the Blum building, about 400 tons, has been let to the Brown-Ketcham Iron Works, Indianapolis.

BIRMINGHAM, ALA.

Sales Not Heavy, But Prices are Firm. —Deliveries More Active.

April 1.

While the inquiry and demand for pig iron in the Birmingham district was quiet during the past week, deliveries on old orders were more active than they have been in a long time. As a consequence, the past month shows up well as far as deliveries go, and the surplus iron, cast iron pipe and other kindred products in this district are being worked off rapidly. By surplus iron it must be understood that the accumulated but sold product is intended. The furnace companies in this district have sold so far ahead that the little lull in the inquiry and demand brings about no apprehension that the market is not going to retain its strength, but to the contrary acts as opportunity to give the manufacturers a little breathing spell. Several sales were made during the month just passed for delivery during the last quarter of the year. Quotations have not changed one whit save perhaps to stiffen a little. Even the smaller companies in the district are now quoting No. 2 foundry at $19 per ton, for last half.

The Tennessee Coal, Iron & Railroad Co. will soon begin the work of practically rebuilding the steel rail mill at Ensley, in order to double the capacity of the plant, bringing the production to 600,000 tons per annum. This is only a part of the plans for general improvement and development mentioned several weeks ago, when John W. Gates and other directors gave out the information that the Tennessee company intended expending many millions of dollars in development.

Edgar M., and Sam Adler have withdrawn from the Birmingham Iron Co., H. M. Atkinson, P. S. Arkwright and James Boneyman, of Atlanta, Ga., have been chosen president, vice president and acting manager, respectively, of the company. The Messrs. Adler formed the company over a year ago, joining the properties of the Tutweiler Coal, Iron & Railroad Co., the Short Creek Coal Co. and other coal and ore mining companies. They have purchased from the University of Alabama 3,600 acres of coal lands, paying therefore $100 per acre. It is not stated whether the purchase was made for speculation or for development. The same interests taking charge of the properties of the Birmingham Iron Co. are those in the Atlanta, Birmingham & Atlantic railroad, now building from Brunswick, Ga., to Birmingham. This railroad will get its fuel in this district and will handle its own iron traffic besides carrying coal to the Atlantic.

BRITISH IRON MARKET.

Heavy Demand—Some Melters Short—Tone Improves.

Office of THE IRON TRADE REVIEW.
Prince's Chambers, Corporation St.
Birmingham, Eng., Mar. 22

The position of pig iron during the past week has showed a marked improvement, and, though there was a slight reaction yesterday, this was believed to be temporary, and is not sufficient to discount the decided upward movement. Monday in particular was a good day for business, the market being active and strong, mainly in response to the better tone of American reports and the large withdrawal from store at Middlesbrough on Saturday. On that day the transactions totaled 32,000 tons. The Middlesbrough stores were reduced between Friday and Saturday from 480,755 tons to 477,885 tons. The prices on Monday were £2 14s 5½d cash ($13.33) for Cleveland, and £2 14s 10d, ($13.42) one month. Yesterday the figure had reduced to £2 14s 1d ($13.24) for cash, and £2 14s 5d ($13.32) one month. The business totaled 22,000 tons. It is believed that a large demand must be pending for spring and early summer, and very large contracts have been made with European buyers. In the Midland district, users are in the greatest straits for metal. A few days ago, one of our biggest firms was within two hours of stoppage. Fortunately, a couple of truckloads arrived and this, supplemented by all the broken cast-iron that the managers could lay hands upon, prevented the stoppage of the 38 puddling furnaces. In many instances, buyers have fetched small lots in carts to keep their works in operation. The consumptive demand is enormous. Within the past day or two many fairly large contracts have been made through Birmingham dealers, and it is likely that re-buying will be generally resumed.

METAL MARKET.

NEW YORK.

April 2.

Copper.—Exports during March aggregated 16,433 tons. During the first quarter the total movement was in the neighborhood of 39,200 tons, or some 8,000 tons less than in the corresponding quarter of 1906. Imports for the three months just ended approximate 30,000 tons, considerably more than in the first quarter of last year. The market continues extremely quiet. Consumers have covered their requirements until July and there are still some producers anxious to sell, this condition accounting for the recent decline in prices. Current quotations are as follows: Lake 25c to 25½c; electrolytic 24½c to 25c. In the London market yesterday standard copper for spot delivery was quoted at £97 5s, a decline of more than £4 during the week.

Pig Tin.—A better feeling prevails in the local market, though current sales are extremely small. The heavy decline in sympathy with that of copper has been recovered in part and the London situation is stronger. Current quotations are 39½c to 40¼c.

Pig Lead.—A lighter demand is noted with quotations practically unchanged as follows: Spot 6.15c in carload lots, soft Missouri spot 6c. Soft Spanish closed on the London market the last day of March at £19 6s 3d.

Spelter.—The demand is only moderate and trading is not extensive. We quote as follows: Refined, spot, 6.85c to 6.90c in carload lots; St. Louis 6.70c to 6.75c. G. M. B. closed March on the London market at £25 15s.

Antimony.—The market is without strength. Cookson's is quoted at 24c to 24½c, Hallett's at 22c to 22½c and ordinary brands are held at 21½ to 22c.

CHICAGO.

April 1.

General weakness characterized the market during the past week, but the only drop in prices which resulted was in pig tin and copper.

Copper lake continued to sell at 27c, but casting varied between 26¼c and 26¾c. Pig tin sold variously between 43c and 43½c according to the size of the order. Sheet zinc sold for 8.50c LaSalle in car lots of 600 pound casks. Spelter advanced to 7¼c. Lead desilverized was quoted between 6.50c and 6.60c for 50-ton lots and corroding at 7.25c to 7.35c. Carload lots sold 2½c per 100 pounds higher. For

Cookson's antimony 28½c was asked and for other grades 26½c.

The price of old metals dropped heavily during the week. Buying prices quoted were: Copper wire, 18.50c to 19c; heavy copper, 18c; copper bottoms, 17.50c to 18c; copper clips, 18.50c to 19c; red brass, heavy, 17.50c to 18c; yellow brass, heavy, 15.50c to 16c; red brass borings, 16c to 16.50c; yellow brass borings, 13.50c to 14c; light brass, 12.50c; pipe lead 5.25c; tea lead 5c, zinc 5c; tin foil 34c; pewter No. 1, 27c.

ST. LOUIS.

April 1.

Lead is quiet. Missouri brands are offered at $6.05, but no sales. The best bid was $6, which was refused. Special soft brands are held higher.

Spelter is nominal at $6.75. Offerings are light.

The production of both lead and zinc ore in the Missouri-Kansas field for the first three months of this year have been the heaviest in the field's history and still the prices are higher than last year's.

BLAST FURNACE

Will be Built at Hamilton, O., by Edwin N. Ohl and Cincinnati Capitalists.

Announcement has been made that Edwin N. Ohl and a party of Cincinnati capitalists have decided to erect a blast furnace at Hamilton, O., near the site of the present Otto Coke Co., and that the organization has been completed and specifications for the new furnace will be out within a short time. The stack will be 80 x 18 feet, with a daily capacity of 300 tons and will make foundry, basic and malleable iron.

Mr. Ohl at the present time is president of the United Iron & Steel Co., successor to the Cherry Valley Iron Co., with furnaces at Leetonia and West Middlesex, O., and also a furnace at Sharpsville, Pa. At the present time, those interested will give no further information as to their plans aside from the statement that George L. Pearson, for several years superintendent of the Atlantic furnace of the Republic Iron & Steel Co., at New Castle, will probably be manager of the furnace at Hamilton, O.

Mr. Ohl is very closely associated with Alex W. Thompson, former president of the Republic Iron & Steel Co., and served on the directorate of the Republic during the administration of Mr. Thompson. Rumor also has it that the new furnace may be allied with the interests of the Inland Steel Co., of Chicago, of which Charles Hart, former manager of the Republic Iron & Steel Co., with headquarters at Youngstown and Cleveland, is president.

Francis J. Peck & Co.—The firm of Crowell & Peck, chemists, Cleveland, has been dissolved. Mr. Peck purchased the offices and laboratories at 731-5 Williamson building, also the testing and crushing plants, and their complete equipment, retaining a number of the employes of the former firm. The business of mining engineers, chemists, metallurgists and inspectors of building materials will be conducted under the firm name of Francis J. Peck & Co., at the old location. Mr. Peck's fifteen years successful experience in the above lines gives ample assurance of his ability to render expert services.

PERSONALS.

E. M. McIlvain has been elected president and general manager of the Robins Conveying Belt Co., Park Row building, New York. He was formerly president of the Bethlehem Steel Co.

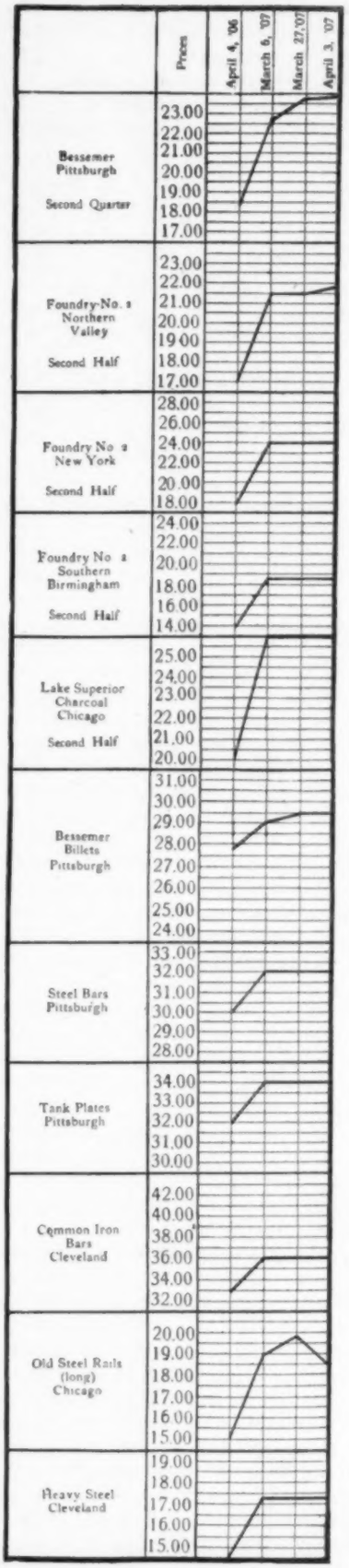
Morgan T. Whitehead, formerly with the Carnegie Steel Co., and Forest S. Rutherford, formerly with the Youngstown Steel & Tool Co., have taken charge of the Western Iron Mills, Denver, on a re-organization and will operate the plant for the manufacture of steel rails and cast iron of all kinds.

W. B. Schiller, president of the National Tube Co., appeared in his Pittsburg office on Monday of this week for the first time since last September, at which time he was thrown from his buggy while driving and his ankle so seriously injured that he has been confined to his home for six months. Mr. Schiller is using crutches.

H. S. Norton, assistant general manager of the Illinois Steel Co., Joliet, Ill., has been promoted to the position of manager of the Gary Land Co. of the United States Steel Corporation. His offices will be in Chicago, but he will retain his residence in Joliet. W. J. Dagget, who has been assistant superintendent of the Joliet mill, will succeed Mr. Norton.

William L. Hayes formerly a member of the bond firm of W. J. Hayes & Sons, Cleveland, has been appointed assistant manager of the American Steel & Wire Co. for the Cleveland district. He will have jurisdiction under Robert W. Ney over the mills in Cleveland, Niles and Sharon. Prior to entering the bond business, Mr. Hayes was for 22 years with the American Steel & Wire Co.

PRICE CHART.


Prices
April 4, '06
March 6, '07
March 27,'07
April 3, '07
Bessemer Pittsburgh Second Quarter
23.00 22.00 21.00 20.00 19.00 18.00 17.00
Foundry No. 2 Northern Valley Second Half
23.00 22.00 21.00 20.00 19.00 18.00 17.00
Foundry No 2 New York Second Half
28.00 26.00 24.00 22.00 20.00 18.00
Foundry No 2 Southern Birmingham Second Half
24.00 22.00 20.00 18.00 16.00 14.00
Lake Superior Charcoal Chicago Second Half
25.00 24.00 23.00 22.00 21.00 20.00
Bessemer Billets Pittsburgh
31.00 30.00 29.00 28.00 27.00 26.00 25.00 24.00
Steel Bars Pittsburgh
33.00 32.00 31.00 30.00 29.00 28.00
Tank Plates Pittsburgh
34.00 33.00 32.00 31.00 30.00
Common Iron Bars Cleveland
42.00 40.00 38.00 36.00 34.00 32.00
Old Steel Rails (long) Chicago
20.00 19.00 18.00 17.00 16.00 15.00
Heavy Steel Cleveland
19.00 18.00 17.00 16.00 15.00

SHIPPERS ORGANIZE

In National Association For Mutual Protection—Other Railroad News.

The organization of the National Freight Service Association, which recently held a convention at Richmond, Va., has been effected by the election of the following officers: President, T. Peyton Giles, Richmond; first vice president, John Donnan, Richmond; second vice president, Douglas Dalnam, New York. Executive committee: John C. Freeman, chairman, Richmond; C. T. Johnson, Canal Dover, O.; V. H. Beckham, Seattle, Wash.; E. D. Taylor, Richmond; John Landstreet, Richmond. Legislative committee: John S. Harwood, chairman, Richmond; S. P. Hastler, Chicago; W. C. Rice, Philadelphia. The object of the organization is to interest freight shippers and receivers throughout the United States in a systematic effort to secure better and quicker transportation facilities through legislation or otherwise.

Will Aid Shippers.

An important step has been taken by the Southern railway in furthering the effort which President Finley is making to establish closer relations between the road and the public. Announcement has been made by A. H. Plant, comptroller of the Southern, of the appointment of a large corps of traveling claim agents, "for the purpose of insuring promptness and justice to its patrons in respect to handling freight at local stations and the handling of loss, damage and overcharge freight claims." These agents will travel constantly.

Will Order Machinery.

C. B. Duffy, purchasing agent of the Hocking Valley Railway Co., is preparing to order the machinery that is to be placed in the woodworking department of the new shops of the company that are to be built at Logan, O., during the coming summer. A power station is to be put in and all the machinery will be electrically operated. The machinery to be purchased includes:

Four side timber sizer, to dress maximum capacity of 14 x 20 inches, to be equipped with power hoist, estimated horsepower 50. Planer and matcher, to dress or match four sides of timber, maximum capacity 6 x 24 inches, built with divided rolls and chip breakers, equipped with heads complete. Vertical car sill automatic tenoning machine, with power feed; capacity of machine, to carry 21-inch heads. Vertical hollow chisel mortiser, short table with boring attachment; chisels to range from ½ to 2½ inches; boring attachment to have transverse movement of 16 inches; maximum capacity of stock 16 inches wide. Heavy band saw; maximum length of blade 20 inches; swing between saw and column, 36 inches; equipped with tipping table, and 38-inch wood rim wheel, blade up to 2 inches in width; maximum lift 18 inches, equipped with "right guide" above and below table. Cut-off saw, 7½-foot table, automatic feed; maximum size of blade 46 inches, stroke 34 inches; to cut 16 x 18-inch timbers. Self-feed rip saw with iron frame and table; equipped with feeding in and out rolls; adjusted to feed work as well as table and to be large enough for 24-inch blade. Vertical four-spindle boring and gaining machine, combined with traveling timber carriage automatic power and hand feed; length of table 38 feet; capacity 14-inch timbers; to be arranged for direct motor drive, separate for each machine; 28 automatic stops. Three-spindle medium heavy vertical boring machine with maximum range of 12 x 16 inches and quick lever adjustment. Automatic knife grinding machine with water stone, automatic pump, automatic feed; for grinding knives up to 36 inches long. Swing cut-off saw to carry 24-inch. saw. Double ended bench emery grinder with universably adjustable tool rests and a planer knife balancing machine.

INCREASE GRANTED

To Molders at Chicago Conference of Employer and Employed.

The conference between committees representing the Stove Founders' National Defense Association and the Iron Molders' Union, at the Auditorium Hotel, Chicago, last week, came to an end Friday night. A wage agreement was reached that will extend to Jan. 1, 1909, an increase from 20 per cent on board prices to 25 per cent, or its equivalent, being granted to the molders. This is one-half less than was demanded. The question of changing the date of conference was brought up at this meeting, the manufacturers preferring December to March as the month in which to hold it, because of reasons affecting the manufacture and sale of their product. The molders' representatives agreed to make an effort to have the date changed at their next convention to be held in Philadelphia in July.

More Ship Builders Out.

One thousand workmen employed as electricians, blacksmiths, pipefitters and carpenters, at the Lorain yards of the American Ship Building Co. joined the strike against the company at its various lake yards March 29 when 100 non-union men were brought in by the company to fill the places of those employes who had previously taken part in the strike movement. The tie-up of the Lorain yards is now complete.

Strike is Settled.

The strike of unskilled labor at the plants of the Republic Iron & Steel Co. and the Interstate Iron & Steel Co., East Chicago, has been settled and the men have returned to work. A 10 per cent increase in wages which was offered by the employers was accepted.

Increased Earnings.—The statement of the American Car & Foundry Co. for the three months ended Jan. 31 last, shows an increase in net earnings of $1,299,171 and in surplus after dividends of $1,149,171. This brings the total surplus up to over $17,900,000.

LARGE ADDITION

Built by the Bury Compressor Co.—Will Double Capacity of Plant.

The Bury Compressor Co., Erie, Pa., manufacturer of air and gas compressors and vacuum pumps, has just completed an addition to its machine shop, 150 x 70 feet, which increases the size of this building to 350 feet. A complete line of boring mills, lathes and tool room equipment has been installed, as well as a 10-ton traveling crane. An overhead heating and ventilating system has likewise been added and a generating set of sufficient capacity to light the plant and furnish all the power required. These improvements will practically double the capacity of the plant and by the rearrangement of the machinery a commodious testing floor will be provided. A new line of high pressure compressors for starting large gas engines is now being added, and orders have already been received for several large units.

Contracts recently booked are as follows: Carnegie Steel Co., compressor for construction shop, Waverly, N. J.; Brooklyn Rapid Transit Co., Brooklyn, N. Y., two compressors; North Penn Iron Co., Philadelphia; Carr & Ball, Harrison, N. J.; De La Vergne Machine Co., New York; St. Louis Frog & Switch Co., St. Louis; Carnegie Steel Co., Donora, Pa.; Pressed Steel Wheel Co., New Castle, Pa.; New England Refrigerator Co., Norwich, Conn., two special high-pressure compressors; Standard Roller Bearing Co., Philadelphia; American Clay Machinery Co., Bucyrus, O.; American Steel & Wire Co., Cleveland; Merrell-Soule Co., Syracuse, N. Y.; Wilson-Snyder Co., Pittsburg; Duff Construction Co., Allegheny, two large direct-connected motor-driven vacuum pumps for the city of New York; Schumacher & Boye, Cincinnati; Cincinnati Milling Machine Co., Cincinnati; National Car Coupler Co., Attica, Ind.; E. W. Bliss Co., Brooklyn, N. Y.; Victor Talking Machine Co., Camden, N. J.; Pope Motor Car Co., Hartford, Conn.

Fenwick Freres & Co., Paris, France, are the representatives of this concern for Belgium, France and Italy, and recently an order for the French government for a 2-stage belt-driven compressor was received, a duplicate of a machine furnished a year and a half ago. This company also reports an active demand for its machines from Mexico and Japan.

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April 4, 1907.

PIG IRON IMPORTS ARE DECREASING.

The import movement in pig iron is evidently on the wane. The record figure in this movement was for December, which showed a total of 74,412 tons of pig iron imported, this including spiegeleisen, ferro-manganese and the silicon metals. January imports were 50,005 tons, while the February statistics, just out this week, show 48,982 tons.

Imports in the calendar year 1904 were 79,500 tons and in 1905 212,466 tons. In the first nine months of 1906 they averaged 25,542 tons, which may be taken as about normal in the present state of trade for the various special grades, anything above 25,000 tons in a month representing the special imports of ordinary pig iron, due to the great scarcity in this country. Based on this assumption our special imports in October were 10,000 tons, in November 15,000 tons, in December 50,000 tons, and in January and February about 25,000 tons each, a total of 125,000 tons in five months, on this movement. Iron yet to come in may bring the grand total to 200,000 tons.

This is not a great movement. In 1902 we imported of all grades of pig iron 625,383 tons, and in 1903, 599,574 tons, but in the single twelvemonth ending June 30, 1903, we imported 956,198 tons, of which doubtless more than 800,000 tons represented abnormal imports.

Had foreign pig iron markets been more inviting, in the past six months, our pig iron imports would doubtless have been heavier. It may be well enough that they were not, as they were more inviting in 1902, and we bought a great deal more pig iron than really was needed, much to the confusion of the industry in the latter part of 1903. On the other hand, foreign pig iron could not well be bought in 1899, and domestic prices reached such a height that a slump came in 1900. In the present movement, pig iron advanced, but finished steel prices were held down—in striking contrast to 1899—which will help greatly in the readjustment. On the whole, it is probably a good thing that domestic consumers have not been encouraged by the international relationship of prices to buy foreign iron freely.

FORGOTTEN MILLIONS.

The members of the industrial peace committee of nine under the provisions of the Foundation for the Promotion of Universal Peace established by President Roosevelt, have been announced as follows: On the part of the public, Archbishop Ireland, of St. Paul, Marcus N. Marks, of New York, and Ralph M. Easley, of New York; on the part of employers, E. H. Gary, chairman finance committee and board of directors, United States Steel Corporation; Lucius Tuttle, president Boston & Maine railroad, and J. Gunby Jordan, of Columbus, Ga.; on the part of employes, Samuel Gompers, president of the American Federation of Labor; Daniel J. Keefe, president of the Longshoremen's Association, and Warren S. Stone, grand chief of the Brotherhood of Locomotive Engineers. Some of these selections, such as those of Archbishop Ireland and Judge Gary, will be heartily commended. Mr. Keefe and Mr. Stone are worthy representatives of union labor, but we regard it as unfortunate that a noisy agitator like Gompers was included, and that the great body of unorganized employes, who are much more numerous than the union men, is entirely without representation. It is strange, indeed, that the distinguished men who appointed this committee did not see fit to appoint some one who does not wear the union brand. The fact is due, we believe, to a large extent to the failure properly to present the matter to Secretary Straus and others entrusted with the power of appointment. Until recently, very little had been said about the subject. Organized labor, always more prominent and persistent than the unorganized forces in urging its claims, was considered, while the millions of unorganized workmen were forgotten. We trust this fact will be borne in mind in the event of a vacancy occurring in the committee.

The committee represents a large amount of experience in handling labor problems, and we earnestly trust that it will accomplish much in bringing about more satisfactory industrial conditions.

SOME TENDENCIES IN ARCHITECTURE.

The approaching dedication of the Engineering Societies Building, a description of which is presented in the current issue of this publication, may well serve to center attention on certain remarkable attainments in architectural beauty and convenience which mark the highest type of present day office structures. The same tendencies are also emphasized by the recent booklet of a leading structural interest, carrying illustrations of some of the more conspicuous examples of recent or prospective construction work. In all of these the one striking feature is an air of symmetrical completeness, a subjugation of details to one general, dominating idea and the arrival, through these means, at a simple, dignified style of structure certain to continue in thorough good taste as long as it can be expected to endure.

When it is considered that, coupled with this, the modern office structure can claim distinction by reason of its incorporating all that recent architectural and engineering progress has contributed toward the comfort of its tenants, we may conclude that there has been ar-

rived at in this country a type which for capacity, convenience and beauty stands unrivaled. This has been accomplished, not by any radical change in construction tendencies, but has come about as a gradual development,—by accepting what has proven desirable in the best examples of design in the past and by taking advantage of all that has been offered by the rapid development of the steel structure during the last decade.

There has been a marked disposition of late for architects to avail themselves of the building regulations of certain large cities—which permit the use of only a maximum percentage of ground space—in working out what may be termed the monument type of building. In this a slight space is left on all sides of the structure, thus allowing a uniform style of treatment all about the building and the designing of a lofty structure that is at once well-balanced, amply supplied with light and air and presenting an artistic appearance from any point of view. Instead of the blunt, angular and painfully regular shaft which was the earlier form of skyscraper, the tall office structure of today may combine several styles of architecture; it may have its base of several stories done in a heavy, solid design, its central section of perhaps twice that height in a plainer style and its upper stories in a more elaborate finish, yet blending well with the lower architecture and forming a fitting capstone for the monumental whole. This form of structure is well exemplified in the Engineering Societies Building and in many other instances of recent construction work. It marks a high attainment in modern American design and is apparently the form of building which is to survive.

A PLEASING PROSPECT.

While the stock market is engaging so much attention and the effect of the depression in values for securities on the general business outlook is being considered, a brief presentation of conditions in the agricultural districts seems to be pertinent. Such conditions are not subject to manipulation and are regarded by many as the determining factor in the final analysis as the basis for general business.

While it is too early to offer any definite information as to what the harvests may be this fall, it is not too early to state what the outlook at this time offers in the way of probabilities. The acreage sown to winter wheat is slightly larger than a year ago. The condition of the growing plant is good in most of the central regions with the exception of portions of Ohio, Michigan and Indiana, where the top growth was frozen by the cold weather in February and March. This does not mean, however, that the fields so affected are beyond hope and there is much to encourage the belief that in a large part of the area so affected the roots are still vital and fair results may yet be realized. In the west, especially in Kansas, the outlook for the growing crop is excellent. A good wheat crop is, therefore, a probability and almost a promise.

The warm weather which prevailed the latter part of March was favorable to agricultural affairs, enabling the farmers to begin spring work earlier than usual. Sowing of oats has commenced under good conditions, and the soil is in excellent shape for working. An average acreage is indicated by reports received up to this time. Plowing for corn has begun, and there seems to be a general belief that a full acreage of this cereal will be planted.

In reviewing reports from the interior districts, there is general satisfaction on the part of the farmer with prices being realized for the portion of the old crop still being marketed. In spite of the reports of car shortage, the receipts of grain at market centers are larger now than at the corresponding time last year. Prices for live stock are higher than for years. Farm lands are increasing in value. There is a condition of content and prosperity in the agricultural regions rarely equaled.

The demand for horses suitable for work on the farms indicates that the lands will be worked to full capacity this season. There is nothing in sight at this time of an unfavorable nature, as affecting the outlook for a good crop year. Fruit is promising and small garden truck has been planted early.

There may be untoward conditions develop to disturb the crops in their progress, but at this time the promise of the season is decidedly hopeful.

THE STEEL TIE QUESTION.

(Engineering News.)

It is unfortunate that the report of the committee of Pennsylvania R. R. officials which investigated the recent derailment at Mineral Point, Pa., appears to cast some degree of discredit on steel ties. We say "appears," because it is admitted that the steel ties had nothing to do with *causing* the derailment. As to the expressed opinion that less injury to the track would have resulted if wooden ties had been in use, it is important to observe that this is nothing more than opinion, and that opinion on the subject of possible relative damage in railway accidents is of little or no value.

The results of railway accidents follow no laws. In one case a derailed car may run along the track and do little damage, while in another case, under apparently precisely similar conditions, it will tear up the track and smash the ties, or perhaps break spikes and splice-bolts, for a considerable distance. Yet upon the mere suppositional opinion that the damage to the track was more severe than would have been the case with wooden ties, the committee recommended the removal of the steel ties. The general impression was thus created—and this is the unfortunate part of the matter—that steel ties make railway track less safe for high-speed traffic. In view of the fact that the steel tie has been struggling hard for recognition in this country, after the experience with it in Europe has been very satisfactory, and in view of the great importance of developing useful substitutes for the conventional wooden tie, this erroneous impression threatens to work injury to a promising technical development in railway practice.

A matter more easily overlooked than the suppositional nature of the opinion that less damage would have resulted on a wood-tie track, is the fact that the recommendation to remove the steel ties does not logically follow from the opinion. The function of track is to carry trains safely on the rails, not to possess maximum resistance to the impact of derailed trains. If track composed of rails bolted to ties (as with steel ties) is superior to track with rails spiked to wooden ties—as may perhaps be found to be the case with proper design and construction—it is questionable whether possible liability of greater injury to the steel-tie track in case of derailment would be a good argument against its use.

In a letter to the editor of the *Railroad Gazette*, A. C. Shand, chief engineer of the Pennsylvania railroad, says:

"I would be greatly obliged if you would call the attention of your readers to the fact that after most careful observation and study of the subject I am more than ever impressed with the necessity in the near future of a substitute for wooden cross ties, and so far no material has been offered as a substitute that will meet the requirements except metal. I think, however, that all ties tested are a little lighter than they should be and am firmly of the opinion that none of the fastenings for holding the rail in position

to the tie is adequate to the requirements. This was empasized in the accident we had, above referred to.

"When any suitable fastening shall have been designed, and there is no doubt in my mind that it will be in the near future, either by the Carnegie Steel Co. or by someone else, I have not the slightest doubt that the experiments in connection with the steel ties will go forward, not only on this system but on other leading railroads.

"On the Pennsylvania railroad alone we are using about 4,000,000 cross ties a year, and with the increased price for cross ties in the last five years and the difficulty in purchasing even at the increased price, it is obvious that some substitute must be secured before long. The quality of the timber also has depreciated enormously in the last five years, so that it becomes imperative that we should either purchase the best cross ties that the market affords and creosote these ties and use heavy tie-plates, or secure a steel cross tie or one of some other composition which will answer the requirements."

ANNUAL REPORT

Of Otis Elevator Co. is Submitted to Stockholders.

The Otis Elevator Co., in its annual report for the fiscal year ending Dec. 31, 1906, submitted at the meeting of the stockholders, shows the following income account as compared with that of the previous year:

	1906.	1905.	Increase.
Net earnings...	$ 855,167	$ 912,938	*$ 57,771
Pref. divid'ds..	347,791	339,697	8,094
Balance.....	$ 507,376	$ 573,241	*$ 65,865
Com. divid'ds...	191,259	127,006	64,253
Balance.....	$ 316,117	$ 446,235	*$130,118
Depreciation ...	216,117	246,235	*30,118
Surplus.....	$ 100,000	$ 200,000	*$100,000
Prev. Surplus..	1,600,000	1,400,000	200,000
Total Surplus.	$1,700,000	$1,600,000	$100,000

*Decrease.

The stockholders at their meeting re-elected the following directors: William D. Baldwin, A. C. Mills, W. H. Baker, C. G. Comstock, A. B. Butler, F. W. Roebling, G. B. Rebmann, E. A. Russell and W. S. Spaulding. President W. D. Baldwin in his report says: "The volume of business for the past year has been in excess of any previous year, and the outlook for this year is promising. There has been expended for the purchase of real estate, new buildings, equipment (exclusive of repairs and maintenance of plants), and acquisition of outstanding stock of subsidiary companies, the sum of $1,214,420, of which sum $1,020,420 has been paid in cash and the remainder in stock from the company's treasury."

The Denver railroad has awarded the contract for the erection of new car shops at Childress, Tex.

RAILROAD BUYING

Not So Brisk in Chicago Machinery Market.—The Labor Situation.

Office of THE IRON TRADE REVIEW.
1362 Monadnock Block, April 2

The effect of unsettled stock market and labor conditions has continued to be noticeable in the local machinery market for the past week. It has been particularly pronounced with firms which deal largely in railroad tools. The slackening comes principally from railroads and corporations whose stocks are listed. Many orders which had been placed have been held up temporarily awaiting developments in the situation.

The volume of business has not been affected and the effects, if there are any, will be in the future. Watchfulness rather than uneasiness is shown by the businessmen.

Present deliveries are continuing as fast as the manufacturers are able to get out the machines, and no machines which were ordered have been refused. The inquiries also continue at the rate of the last year. Only orders which had been negotiated and not finally closed, or on which no work has been done show the influence of the situation.

Persistent rumors circulated among the trade that several large orders for cars recently placed by railroads have been cancelled during the past week. The rumor gained much of its strength from the light purchases made by the railroads in all lines. Besides the small purchases of machines the effect was felt in building materials, metals and all the supplies bought by railroads. No definite confirmation of the rumor could be obtained. E. R. Slagle of the Pullman Co., denied absolutely for his firm that any orders have been cancelled. He did not discuss whether requests had been made by any railroad to hold up temporarily orders for cars recently placed, but confined himself to the flat statement that no cancellations had been made.

The labor situation has been closely watched by members of the machinery trade and the threatened strike of the railroad men has caused worry because of its possible effect on general business conditions.

No definite steps by either side have been taken in the strike of the machinists which was talked of and the possibility of trouble is belittled by most employers.

George H. Tompkins of the National Metal Trades Association says the labor conditions this spring are favorable and that there is small probability of a machinists' strike in Chicago. If called, it would affect only a few firms and none of the members of the association Two small strikes at Moline, Ill., have been dealt with by the association during the past week. The machinists employed by the Root & Vandervort Engine Co. and the Williams-White Co. went on strike. Of the 250 men employed, less than 50 were affected and their places were filled by men from Chicago. Mr. Tompkins personally took charge of the situation.

The Illinois Bolt, Nut & Forging Co., Chicago, a recent incorporation, has completed its new plant at Thirty-fifth street and Ashland avenue, and it will be ready for operation by April 15. The building is one story, 100 by 160 feet. The officers of the company are: president, P. H. Joyce; vice president, Lloyd J. Smith; secretary and treasurer, M. L. Hunt, 184 LaSalle street.

HEAVY LOSSES

Reported by the Bethlehem Steel Corporation.—New Plant Nearly Ready.

(Special Telegram.)

New York, April 3.—The operating account of the Bethlehem Steel Corporation for the year ending with December last, was presented at the annual meeting held Tuesday in Newark, N. J. The meeting was entirely harmonious, the representative of the minority interests withdrawing all complaints because of a cut in the preferred dividend rate. The annual statements showed heavy decreases in earnings and was generally unfavorable. Manufacturing profits were $1,859,353 against $3,468,802 for the previous year. As extraordinary losses an item $1,118,467 was charged off, representing losses on merchant and battleship construction and on San Francisco plants through the earthquake. Contracts taken by the United States Shipbuilding Co., but not completed by it were at figures insuring a loss of $1,725,000. Bookings of the Corporation for the year aggregated $16,216,570, and unfilled orders at the close of the year $13,300,885. Preferred dividend and extraordinary loss charges reduce the surplus of the previous year by about $1,250,000. The report notes the curtailment of government armor plate orders and states that by July the new commercial plant will be in partial operation, giving the concern a wider range of products. No action was taken on dividends.

LARGE RAIL ORDERS PENDING.

(Special Telegram.)

New York, April 3.—Rail sales of the week have been small with an aggregate tonnage of about 8,500. Inquiry, however, is large and several important contracts are pending.

ANNUAL BANQUET

Of Worcester Metal Trades Association.—Large Increase in Membership.

Worcester, Mass., April 1.—Worcester branch, National Metal Trades Association, gave its fifth annual banquet March 29 in Mechanics hall. Chancellor James R. Day, of Syracuse University, was chief speaker, his subject being "The Accumulation of Wealth and the Political Control of Business." Boiled down, he said: "A man has a right to acquire the title to land if he can take it honestly and other people are willing to surrender it. It is a great deal better to try to make all the money in the world than not to try to make any. There is no such thing as tainted money."

President George F. Brooks presided and gave a brief historical sketch of the association. The membership June, 1906, was forty-seven firms. March, 1907, it was 63 firms. The sixty-three members employ about 10,000 people. Members are in Worcester, Fitchburg, Winchenden and Southbridge, and soon other towns will be added as the district, from March 1, comprises Worcester county, two counties in New Hampshire and the state of Rhode Island. Among the fifteen branches of the N. M. T. A., Worcester stands fifth. Out of a population of 135,000 Worcester has 30,000 skilled mechanics. About 350 people attended the banquet.

The Coes Wrench Co. is to build large additions to its knife works, which will increase its manufacturing capacity 150 per cent. Parts of the additions will be used for the wrench business. There will be three new buildings. A wooden building 54 x 62 ft. will be devoted to the hardening department and the rolling mill proper. A one story brick building, 25 x 110 ft., will be occupied by the grinding machine and straightening departments. This building will be connected with the older works by a one story passageway. A new office building, three stories, and 30 feet square, will contain main and private offices, drafting room and vaults. This building will be of steel and cement construction and fireproof. The grinding, machine and straightening building will have a saw tooth roof, of copper, the first of the kind in Worcester. The driving power will be furnished by a new 135-H. P. Westinghouse generator. This is the seventh extension of the knife department in twelve years. Excluding the "key model" wrench, the output last year was 720,000 wrenches.

Wm. A. Smith, clerk and treasurer of the Worcester County Mechanical Association, celebrated his eighty-third birthday March 2. Mr. Smith is the oldest living graduate of Harvard and is serving his thirty-fifth year in his present position.

James W. Wall, of the state branch of the American Federation of Labor is undertaking to affiliate the various local unions with the state branch, and is succeeding.

EXPENSES INCREASED.

Unusually heavy expenditures for expansion of business and equipment in addition to large depreciation and adjustment charges have resulted in the Canadian Westinghouse Co. being unable to show a gain in surplus for 1906 in its annual report just issued. Net earnings, however, registered a material increase and the profit and loss surplus was larger. The net earnings aggregated $346,961, a gain of $126,416, but depreciation and adjustment charges involved $120,000, an increase of $120,000, leaving a balance of $226,961, an increase of $6,416. Dividend disbursements were $179,550, or $30,450 more than those for 1905, leaving a surplus of $47,411, or $24,034 less than that for the preceding year. Profit and loss surplus, however, amounted to $279,452, or $47,411 more than in 1905. President George Westinghouse says that the gross shipments of the year increased approximately 40 per cent, and unfilled orders on Jan. 1, 1907, aggregated $1,637,658. The stockholders re-elected all the retiring directors at the annual meeting held at Hamilton, Ont.

STEEL CORPORATION'S ANNUAL MEETING.

The annual meeting of the United States Steel Corporation will be held in Hoboken on April 15. Proxies are being solicited in the names of J. P. Morgan, Henry C. Frick, Elbert H. Gary, N. Thayer and Norman B. Ream. The notice sent to stockholders, states that the business to come before the meeting will include the consideration and voting upon the approval and ratification of all purchases, contracts, acts, proceedings, elections and appointments by the board of directors or the finance committee since the previous annual meeting on April 16, 1906. The particular business to be brought before the stockholders will be the approval of the lease for the Great Northern ore lands.

Spang, Chalfant & Co., Pittsburg, on April 1 increased the wages of its laborers at the Etna, Pa., plant 15 cents per day. About 200 men are affected.

STOCK GAMBLERS' LOSSES

Need Not Worry the Country, Says Mr. Carnegie.—A Good Indication.

Speaking at the reunion and dinner of the United States Military Telegraph Corps at New York, March 28, Andrew Carnegie referred to the dealers in stocks in the following language:

"A few gamblers in Wall street may be in trouble. There will always be some of them in trouble, whichever way the market goes. The fellow who is buying will be in trouble when the market drops and the fellow who sells what he hasn't got will be in trouble when the market rises and the fellow that loses will always be of the opinion that the president has gone just a little too far.

"Gentlemen, it is a good day for this country when the stock gamblers come to grief, and I wish I could invent a system whereby both parties to stock gambling would suffer. I am speaking now as a business man and as one who never made a dollar by gambling in stocks and who would as soon make it that way as by playing cards, bridge whist and so on.

"Wall street is not America. There are some places outside of Wall street, even in New York city. The stock gambler is a parasite who feeds on values and creates none. It is time that we should rise and decline to do business with those who make money without giving any value in return for it."

Mr. Carnegie went on to say that this country had in the last five years had prosperity the like of which the world had never seen. If he were selling the stock of the Carnegie Steel Co. now, he added, it would cost the purchasers another $600,000,000.

"The best indication of today," he continued, "is the trouble in Wall street. It is an eruption that is coming out instead of sinking in. Let us hope that tomorrow things will be lively and that stocks will go down for what has gone up must always come down. The market wants a jolting down, down, down—until values come to their level. Then, such is human nature, they will go up, up, up again and you can not prevent it."

Book Plates Destroyed.—Recent inquiries for the work "Analysis of Pig Iron," by the late S. R. Church, has brought forth the announcement that the stock of these books was destroyed in the San Francisco fire as well as the plates for the work. A. L. Taylor, successor to Mr. Church, states that it is not likely the book will be republished.

EARLY ORE HISTORY

Recalled by the Death of Jacob Reese, Long a Resident of Pittsburg.

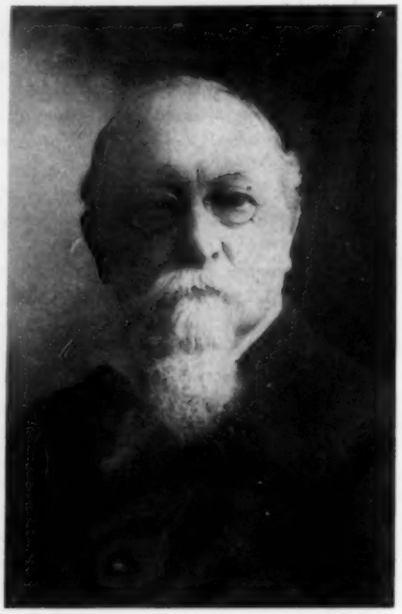
Jacob Reese, one of the first men in the United States to recognize the value of Lake Superior ores, at a time when it was generally believed that they were worthless, died suddenly, March 25, at his home in Darby, near Philadelphia. He was born in July, 1825, in Wales, and came to America with his parents in 1832. The family went to Pittsburg within a few months after arriving in this country, and there Jacob Reese made his home until he retired from active business in 1887. He was an inventor, having taken out some 200 patents in connection with the maufacture of steel and iron. He and his father are said to have made the first iron by the boiling process in the United States. He is also given credit for inventing the universal mill. He was for many years senior member of the firm of Reese, Graff & Woods, who operated rolling mills at Pittsburg. He had a winter home at Daytona, Fla., and came north only a few days before his death, having spent the entire winter there.

Jacob Reese is deserving of a distinct and honored place in the history of the American iron trade for he was a prophet crying in the wilderness. His first order was given to the Cleveland Iron Mining Co. in 1855. It was the first real order that the Cleveland Iron Mining Co. received after the canal opened.

The Sault Ste. Marie canal was opened in 1855 and the Cleveland Iron Mining Co. shipped during that year 1,449 tons, which was the total shipment of the range, the Jackson Iron Co. not being prepared to ship any at all that year. The first cargo of iron ore carried through the canal after it was opened was in the brig Columbia, consisting of 134 tons. The Columbia was followed by the schooner George Worthington three days later with 322 tons, and by the propeller General Taylor with 50 tons. This ore was dumped on Crawford & Price's dock, Cleveland, where it was shortly thereafter seen by Jacob Reese. He placed an order with the company for some of the ore at once.

DEATH OF CHAS. H. HAWKINS.

The death of Charles H. Hawkins, of Chicago, which occurred at his home in that city, March 24, has removed another of the connecting links with the days when iron and steel interests of the country were represented by a few charcoal furnaces and puddling mills. Mr. Hawkins was 73 years old at his death. For the past three years, on account of ill health and the infirmities of old age, he had not actively engaged in business. A man of sterling character and kindly disposition, possessing a thorough knowledge of his business, he was, when in his prime, one of the best known and most successful iron and steel salesmen and manufacturers in the central west. He was highly esteemed by everyone who enjoyed his acquaintance and friendship, and his death is greatly regretted. He is survived by a widow and one daughter. Mr. Hawkins was born in western Pennsylvania in 1834 and commenced



CHARLES H. HAWKINS.

his experience in the iron business at an early age, starting as a mill hand immediately after leaving school. From that time until his retirement, he was continuously engaged in one capacity or another in this business. He went to Chicago in 1876 to enter the employ of John B. Ayer & Son, and after the failure of that firm was employed for a long time as assistant to the receiver. Following the winding up of the company's affairs he became Chicago representative of the Brown-Bonnell Co., Youngstown, O., a connection which he managed with ability, building up a highly prosperous business for the company. He remained with the Republic Iron & Steel Co. for a short time after the merger of the Youngstown firm with that corporation, retiring therefrom to accept the sales management of the Emlyn Iron Works, East Chicago, Ind.

Joseph Blauvelt, for 30 years purchasing agent of the Passaic Steel Co., Paterson, N. J., died March 27, at his home in that city of a complication of diseases. He was connected with the iron industry in Paterson for 50 years.

Thomas B. Brannon, for a number of years superintendent of the Lewiston Foundry & Machine Co., Lewiston, Pa., died March 25.

George H. Hess, president of the Hess Heating Apparatus Co., Chicago, died March 23 of heart disease, at a hospital in San Diego, Cal., at the age of 74.

John McCarthy, for eight years superintendent of the Emma furnace of the American Steel & Wire Co., died March 26 at his home, Cleveland. Mr. McCarthy's age was 46.

David Knauer, aged 82 years, died March 17, at Knauerton, Chester county, Pa., Mr. Knauer was part owner of the rolling mill at Douglassville, and operated a furnace in the Shenandoah valley at Woodstock, Va.

Nathan Francis Marshall Sr., well known in steel circles, died March 20 at his home in Braddock, Pa., aged 58. He assisted the late Capt. W. A. Jones and others in the building of the Edgar Thomson steel works for the Carnegie Steel Co.

Charles B. Weston, one of the founders of the Oxford Wire Nail Co., Oxford Furnace, N. J., died recently at the home of his daughter in Newark, N. J., from injuries received from a fall on an icy sidewalk. Mr. Weston was 72 years old, but retired from business in 1873, having for 27 years been general manager of the nail company which he founded.

Thomas Palmer, a pioneer of the iron industry of Cleveland, died in that city March 16. He was born in England and on coming to America in 1855, was employed by Hewitt & Cooper, becoming superintendent of the company's plant at Trenton, N. J. In 1865 Mr. Palmer came to Cleveland and operated the old Butterfly iron mill and later was made superintendent and manager of the Cleveland Rolling Mill Co., at Newburg, in which capacity he remained until his retirement 10 years ago.

Peter H. O. Willebrands, vice president of the Willebrands Machinery Co., and a pioneer resident of Detroit, died at his home in that city March 29 at the age of 81. After going to Detroit in 1862, Mr. Willebrands entered the machinery business as an employe of James Jenks, and finally went into business for himself 30 years ago. After a long and profitable career he retired recently from active service in favor of his son, George W. Willebrands, president of the company. Another son, B. O. Willebrands, will succeed him in the business which he established.

ENGINEERING SOCIETIES BUILDING IN NEW YORK.

ANDREW CARNEGIE'S GIFT TO THE ENGINEERING PROFESSION.

**Unsurpassed Accommodations for Meetings and Professional Sessions.—
Separate Quarters for Different Societies.—
A Magnificent Technical Library.**

The dedication, April 16-18, of the Engineering Societies Building will mark the realization of ambitions cherished a score of years for a monumental structure in New York City to serve as the home and meeting place for the leading engineering organizations. How magnificent is this accomplishment can be appreciated only by a visit to the building. Its broad, marble-columned foyer, its winding stairways, its great auditorium accoustically perfect, its wealth of smaller assembly rooms, its airy, comfortable offices for the founder societies and generous provision for allied organizations, and finally, high above the noise and dirt of the city, its two wide, well-lighted floors set aside for the collection of the best that engineering literature offers—all these are ample evidence of the thoroughness with which the edifice has been planned and erected. It is a building constructed for all time, rich in every detail, yet in its general effect revealing a simplicity which is perhaps its greatest charm.

Andrew Carnegie's Gift.

Opposite the stone-carved doorway and across the central court, the visitor is attracted by a large bronze tablet which tersely tells the story of how the structure was made possible. Below a fine bas-relief of Andrew Carnegie appears this note addressed to the three societies and the Engineers' Club:

"It will give me great pleasure to devote, say $1,500,000 to erect a union building for you all in New York City. With best wishes, very truly yours, Andrew Carnegie."

Nearby, another panel carries a similar tablet with these words:

"For the advancement of the art and science of engineering. The site presented by members and friends of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the American Institute of Mining Engineers."

In these brief sentences the artist has traced the history of the beautiful building and has commemorated those factors immediately responsible for its erection. It remains to be told, however, that the complete history of the project covers a period of a score of years, from the time of the earliest discussions of plans for the bringing together in one centrally located structure of the offices, libraries and meeting places of the various engineering societies having their headquarters in New York. With the formation of additional societies, the growth of libraries and the increasing difficulty of securing satisfactory assembly rooms the desirability of such centralization became more aparent and the agitation grew. Finally, in 1895, W. D. Weaver, a member of the American Institute of Electrical Engineers, presented the plan to Mr. Carnegie and found that it met with his thorough commendation. But the matter was allowed to drag for a number of years and it was not until early in 1903 that it first gave promise of early success. The institute held its library dinner at Sherry's on February 9 of that year, and Mr. Carnegie was present to speak of the need of co-operation among engineers. The following day he sent for C. F. Scott, president of the institute, and C. W. Rice, chairman of its building committee, to discuss the idea of a union engineering building.

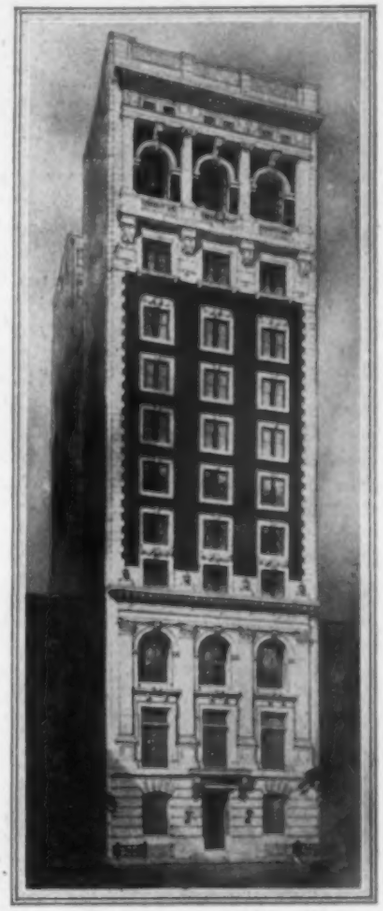


FIG. 1.—THE ENGINEERING SOCIETIES BUILDING, NEW YORK.

It chanced that the Engineers' Club had just secured a site for a new home on West Fortieth street, opposite the new Public Library, and the locality appealed to him as one well fitted for such a joint building as was proposed. His decision was quickly reached. Four days later he wrote:

"It will give me great pleasure to give, say $1,000,000 to erect a suitable union building for you all, as the same may be needed."

Exactly one year from that date Mr. Carnegie wrote another letter. The interim had been devoted to the threshing out of a mass of details in connection with the project, and in particular to arriving at a decision as to which organizations, as founder societies, were to take up the work. These, it had been settled, were to be the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers and the Engineers' Club. Incidentally plans and estimates had been prepared and it was found that a larger sum would be required to carry out the work on the lines originally laid down. Mr. Carnegie's second letter was addressed to the four organizations named: it increased his gift to $1,500,000.

The original plan was for the erection of one building on Fortieth street, but unusual difficulties presented themselves, both in connection with the purchase of so much additional land and with combining under one roof all the technical and social functions exercised by these organizations. The solution hit upon was the erection of two buildings with easy access from one to the other,—the club, as first planned on Fortieth street, and the engineering societies home on Thirty-ninth.

Three members were appointed by each of the bodies interested to form a joint conference committee of twelve, the duty of this committee

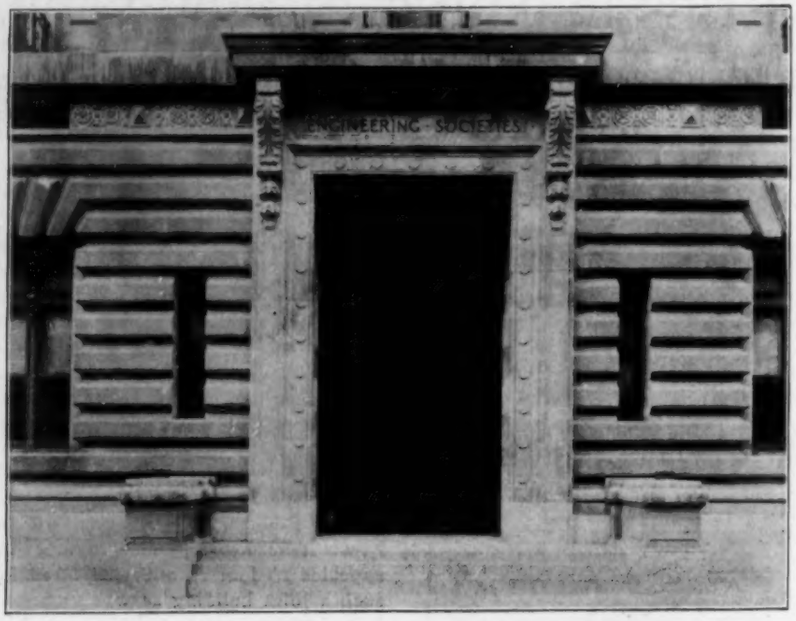


FIG. 2.—ENTRANCE TO BUILDING SHOWING DETAIL OF DOORWAY.

being to accept the gift and erect the building. It was originally made up as follows:

American Society of Mechanical Engineers; C. W. Hunt, J. M. Dodge and F. R. Hutton.

American Institute of Mining Engineers; A. R. Ledoux, C. Kirchoff and T. Dwight.

American Institute of Electrical Engineers; C. F. Scott, C. W. Rice and T. C. Martin.

Engineers' Club; W. H. Fletcher, J. C. Kafer and W. A. Redding.

Mr. Scott was chosen chairman of the committee, Prof. Hutton secretary and Mr. Kafer treasurer. Various changes occurred in the personnel from time to time. Dr. Ledoux was succeeded by E. E. Olcott, Messrs. Rice and Martin were succeeded by Dr. S. S. Wheeler and B. J. Arnold; later Dr. Wheeler gave place to John W. Lieb Jr., Mr. Martin returned to the committee to succeed Mr. Redding, Mr. Kafer died in 1906 and was succeeded by George E. Weed and when this change was made Mr. Kirchoff became treasurer.

On West Thirty-ninth street, but a short distance from Fifth avenue, a frontage of five city lots was secured, a total of 125 feet. The cost was $502,000, the money being loaned by Mr. Carnegie at interest through R. A. Franks, and the three societies pledging themselves to pay one-third. On the north, immediately in the rear, was the site already acquired for the Engineers' Club home, while on the east light and air were insured by the purchase by the club of a large four-story private house of restricted height. Of the original Carnegie gift, $1,050,000 was allotted for the Engineering Societies building and $450,000 for the club building. Then the committee was ready to begin the work of erecting the common structures.

FIG. 3.—THE FOYER ON THE STREET FLOOR.

Selection of the Architect.

The selection of the architect was made something more than a year after the committee was organized, this time having been found necessary for the clearing away of administrative details, the acquiring of title to the necessary real estate, the decision of the method of holding the property, the determination of the actual requirements of the building and the arrangement of an administrative policy. In accordance with the wishes of Mr. Carnegie, the so-called "mixed competition" plan of securing the architect was adopted. Six architects of wide reputation were asked to submit plans, each being paid $1,000 irrespective of whether his designs were accepted, and four prizes of $400 each were offered to architects outside the invited list, all submitting their plans anonymously. When the competition closed in July, 1904, the committee was called upon to consider 26 sets of plans, comprising over 500 drawings. A unanimous decision was reached and, with the approval of Dr. W. R. Ware, professional adviser to the committee, the award was made to Herbert D. Hale, of Boston, and Henry G. Morse, of New York. The firm of Hale & Rogers, with Mr. Morse as associate, carried out the work. The award for the club building was made to Whitfield & King, of New York.

Administration.

At the outset it was found necessary to organize a holding corporation to administer the endowment and property for the Founder Societies jointly and in common. This was formed by special charter in May, 1904, under the name of the United Engineering Society. Its affairs are administered by nine trustees, chosen periodically by the council of the three societies, and with it rests the

title to the land. This form of organization was largely developed through the efforts of Dr. Wheeler; its first president was Dr. Ledoux and the present incumbent is E. E. Olcott.

The erection of the building was a remarkable feat in point of expedition. The contract was closed with Wells Brothers Co., July 17, 1905, the cornerstone was laid by Mrs. Carnegie, May 8, 1906, and the entire building though not entirely finished, was ready for occupancy Jan. 1, 1907, several offices being occupied a fortnight before that date. This was accomplished in spite of a steel strike of a month's duration and a plaster strike lasting two weeks. The building was not only erected within contract time for library purposes. As the building regulations prescribe that only 85 per cent of the lot area can be occupied, advantage has been taken of this limitation to give the structure a symmetrical and monumental appearance.

On the street floor access to the building is gained by the great central doorway, leading into the foyer, by the elevator entrance on the west and by a covered archway for vehicles. In the main elevator shaft are three riseways, and on either side winding stairways reach to the sixth story, one continuing to the library floors. On the first floor a rear door connects through a small areaway with the cafe of the club building and on the tenth floor a covered bridge opens directly into the elevator entrance, which is reached by a short flight of steps. The foyer is furnished with couches and chairs in red leather, this style of furniture also being employed in the smoking and writing rooms, reception and administration rooms, which with telephone booths and shipping offices take up the remainder of the first floor. The decorations throughout are executed in gold.

Taking advantage of the space provided beneath the sloping floor of the auditorium, a large coat room, with toilet facilities, has been provided immediately above the main floor. This is so laid out that several lines of persons may be accommodated at once on arriving or leaving and access to the

FIG. 4.—AUDITORIUM LOOKING TOWARD STAGE.

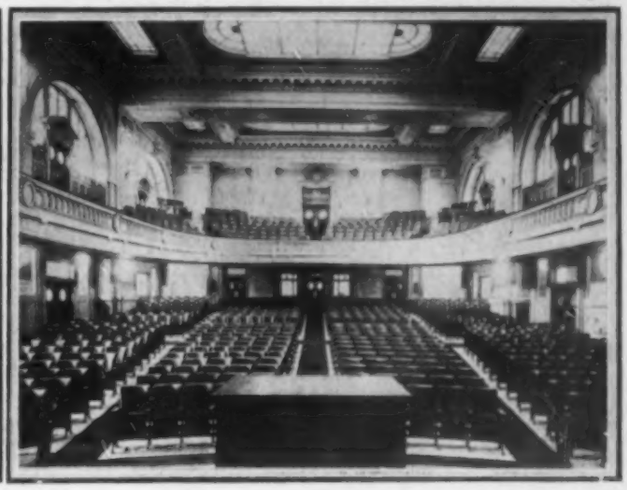


FIG. 5.—AUDITORIUM FROM THE STAGE.

but within the appropriated sum as well, this being possible because of the fact that the original plans and specifications required little alteration and because of the entire harmony existing between the architects, contractors and conference committees.

Architecture.

The completed building is thirteen and one-half stories high and rises slightly more than 218 feet 6 inches above the sidewalk. It is designed in the French style and is dignified though simple in treatment. Up to the auditorium floor the exterior is constructed of limestone and above of gray mottled brick and terra cotta. It contains about 2,650 tons of structural steel.

The exterior of the building shows three sharp divisions in architectural style, this plan being followed to differentiate the three main uses of the structure and to emphasize the way its space has been allotted. The lower floors contain the auditoriums, the middle section is devoted to offices and the two upper floors are occupied the breakfast room of the club on the tenth floor.

The idea of rich simplicity is followed throughout the building in the matter of decoration. All the walls and ceilings are finished in neutral tints, with ample space for the later installation of mural paintings and for the reception of busts, placques and tablets. The hardware is of a subdued brass finish. Every precaution against fire has been taken; iron is used wherever possible and the woodwork reduced to a minimum, with the result that an extremely low insurance rate is evidence of the safe construction and solid workmanship of the building.

Interior Arrangements.

A great central court or main foyer, marked by twelve heavy columns of Swiss Cipolin marble, occupies a considerable part of the first floor and is one of the most beautiful features of the building. The entire floor is laid with Tennessee marble tile, with a colored border design. A removable metal grille separates this court from foyer below or the auditorium above is provided by graceful flights of stairs.

Auditorium.

Of the many complete and commendable features of the building, probably the source of greatest pride to those instrumental in its design and construction is the main auditorium, extending up through two floors and with its gallery comfortably seating about one thousand persons. This is arranged primarily for the general meetings of the societies, at which the speaking is from both the platform and the floor, hence unusual difficulties had to be overcome in meeting these unusual requirements. The stage is small, but a speaker in the audience can easily be seen and heard in any part of the hall. The plans of the walls were submitted to Prof. Wallace C. Sabine, of Harvard, with the result that perfection has been attained, so far as acoustic properties are concerned.

On both the parterre and the gallery floor, at the sides the auditorium is surrounded by corridors, rendering

access to every point very easy, and permitting ready withdrawal for conversation, committees, etc. The corridors assist also in maintaining quiet within the hall. The platform has ante rooms and is conveniently close to the freight elevator, for delivery of apparatus. There is also a fine stereopticon equipped with connections for moving pictures. The seats are fixed opera chairs in red leather with revolvable tops, and the aisles are laid with red carpet. The gallery front is bordered in red plush. Above the auditorium arch is a decorative cartouche bearing the badges of the three Founder Societies. There are side brackets for lighting, but the main illumination is effected indirectly through the glass ceiling, above which are incandescent lamps controlled from several panel boards. The elevators and stairs open directly upon the two floors of the auditorium which can thus be emptied very quickly in case of emergency. Practical tests of the chamber have already shown it to be a success in every respect of comfort and convenience.

Seven lecture rooms of various sizes occupy the two floors immediately above the auditorium. These are so arranged that the building can accommodate audiences of from 1,000 to 100, with every convenience in the way of water, air, electrical connections, etc., for demonstrations and experiments, and so perfect is the planning of these two floors that every room can be in use at once without interference or confusion.

Society Rooms.

The seventh and eighth floors of the building have been reserved for the associate societies that have engineering or some department of science as their principal object. For these organizations the building affords office areas of varying size, from one room up, with the common facilities of the lecture rooms, library and other accessories. Among these societies may be enumerated the Society of Naval Architects and Marine Engineers, the Society of Heating and Ventilating Engineers, the National Electric Light Association, the Society of Chemical Engineers, the New York Electrical Society, the Association of Edison Illuminating Companies and the American Street and Interurban Railway Association.

Each of the three founder societies occupies a floor laid out in accordance with its own plans. The American Institute of Mining Engineers has the ninth floor, the American Institute of Electrical Engineers has the tenth floor, and the American Society of Mechanical Engineers has the eleventh floor. These floors are all devoted to administrative and executive work, and the libraries of the three societies have been concentrated in the two top floors of the building.

FIG. 6.—THE LIBRARY ON THE TOP FLOOR.

The Library.

A crowning detail in the plan of the building has been the reservation of the twelfth and thirteenth floors for the libraries of the three founder societies and of such other collections of engineering literature as may be added. The twelfth floor below the library proper has been devoted to the book stacks, but at the present time the main library is also equipped with one tier of stacks, with provision for a gallery tier later. The stack room is partly equipped with stacks, and in the library a delivery desk, reading tables

and chairs have been provided. The founder societies entertain the ambition of creating and maintaining the finest collection of engineering literature in the world, supplemented by the current periodicals, and all the patents relating to invention in the arts and sciences. Provision is being made for special research accommodation, working alcoves, photographic reproduction, drawing and similar library work. Commanding magnificent views of Greater New York and vicinity in every direction, the library is retired, quiet, free from noise and dust, an ideal haunt of the student and man of research; while open at all times to any reader. In view of the proximity of the new Public Library, the Engineering Societies building with its unequaled collection of scientific and industrial data becomes at once a vital and important center of the highest value for the diffusion of useful knowledge, and the two libraries supplement each other.

Power Plant, Heating and Ventilating.

This brief outline of the building has taken no account of the studied arrangement of every detail and of the thorough manner in which provision has been made for the needs of the future. In the basement 22 feet below the curb, the boiler room is located; slightly above this is the engine room. Ample facilities have been provided for the storage of coal and other supplies and the lifting of ashes to the surface. The boilers, of which there are three of the wrought-steel header type manufactured by the Babcock & Wilcox Co., and other power arrangements are designed for the installation of an electric generating plant whenever desired.

Great attention has been paid to the heating and ventilating features of the building. Radiators, automatically controlled, are placed underneath the windows and the heating is accomplished by low pressure steam. The heating and ventilating apparatus are separated, as the latter is in use only when the building is occupied. The four electrically driven Sturtevant blowers have a total air supply of one hundred thousand cubic feet per minute. Before going to the blowers, the air is filtered for the removal of dust and the finer mechanical impurities. The plumbing system represents the best known features of sanitary engineering.

Illumination.

Unusual and peculiar requirements have been met in the design of the illuminating system of the building as well as in the provisions for electrical energy and telephone service. Connections have been made with two street mains, so that both alternating and direct current is available. As the building is used by various societies, the feeders are subdivided and the switchboard designed to have meters on each feeder. For lighting the three-wire system is employed and for power the two-wire, and throughout the building the system is one of entire flexibility, making possible any kind of service and securing the greatest economy. Current facilities for demonstrating purposes are amply provided.

The illumination of the building is an especially noteworthy attainment, the idea being by screening the lamps to prevent the lights from being distracting or unduly noticeable. Frequent use is made of crystal glass balls, holding "metalized filament" lamps of various sizes. In some instances pagoda reflectors are used inside the balls to increase the effective illumination, while in others a number of lamps are placed, with a silvered metal socket-plate to act as a reflector. In lighting the auditorium, at the engineers' suggestion, the architects provided a space of about 15 inches between the ceiling of the auditorium and the beams of the above floor. At the suggestion of the engineers, also, a glass septum was substituted in place of the proposed plaster panels in the ceiling. The details were then carefully worked out as to obtaining access to the lamps for renewal, and tests were made by the engineers to find a glass that would reduce the intrinsic brilliancy or glare, and at the same time would not have an amount of absorption prohibitive on the score of economy. The result obtained has been very satisfactory, and it is possible to sit through an entire lecture without being disturbed or distracted by the lighting. The general effect is both soft and pleasing, and resembles or suggests sunlight passing through glass, as at Napoleon's Tomb in the Invalides, in Paris. As a matter of fact, the solid arches of the floor above are within two or three feet of the glass through which the light passes. Additional lighting screened by the same kind of glass is provided at the rear and at the sides under the balcony. Dimmers are provided for reducing the amount of illumination in the auditorium to any desired point, and also for the purpose of gradually increasing the lights to the maximum, after the room has been darkened for a stereopticon, thereby avoiding the unpleasant sensation produced on the retina of the eye, by flooding the room with light immediately following comparative darkness.

Hickman, Williams & Co. have moved their Chicago office to larger quarters at 1140 The Rookery.

DETAILED PROGRAM OF DEDICATORY EXERCISES OF THE ENGINEERING SOCIETIES BUILDING.

A tentative detailed program for the dedicatory exercises of the Engineering Societies Building, New York, April 16 and 17, has been issued. The exercises on Tuesday, April 16, are scheduled to commence at 3 p. m., and are as follows:

Music.

Opening, Charles Wallace Hunt presiding; the first use as a gavel of the setting maul employed by Mrs. Andrew Carnegie in laying the cornerstone of the building.

Prayer by the Reverend Edward Everett Hale, chaplain United States senate.

Communications from the president of the United States; the president of the Republic of Mexico; the governor general of Canada.

Historical address by Charles F. Scott, chairman of the conference and building committees.

Acceptance of the building by E. E. Olcott, president of the United Engineering Societies representing the Founders' Societies.

Address by Andrew Carnegie, the donor of the building.

Music.

Oration—"The Professional Ideals of the Twentieth Century," by Arthur T. Hadley, president of Yale university.

On Tuesday evening, April 16, at 9 p. m., a reception will be held, the program for this being as follows: 9 p. m. to 10:30 p. m., general reception in main auditorium; 10:30 to 12, reception by the officers and councils of the Founder Societies in the respective headquarters or floors. Refreshments will be served during the evening on the fifth floor. Music will be provided on two or more floors throughout the evening.

The exercises provided for Wednesday, April 17, beginning at 2:30 p. m. are:

Introduction by John W. Lieb Jr., chairman of the dedication committee.

Addresses by presidents of the Founders' Societies; Dr. Samuel Sheldon, American Institute of Electrical Engineers; Dr. F. R. Hutton, American Society of Mechanical Engineers; Dr. John Hays Hammond, American Institute of Mining Engineers.

Greetings and felicitations from foreign and national scientific societies and institutions of learning.

Address by Dr. James Douglass, past president American Institute of Mining Engineers.

Presentation to Dr. Alexander Graham Bell, of the John Fritz gold medal.

Presentation by A. R. Ledoux, past president of the United Engineering Society, of medals for distinguished services, to R. W. Pope, secretary American Institute of Electrical Engineers; Dr. F. R. Hutton, past secretary American Society of Mechanical Engineers; Dr. Rossiter W. Raymond, secretary American Institute of Mining Engineers.

Indianapolis Meeting, A. S. M. E.—Automobile engineering will occupy one of the sessions of the Indianapolis meeting of the American Society of Mechanical Engineers. Another session will be devoted to superheated steam.

The directors of the New Haven Iron & Steel Co. at their annual meeting failed to act on the dividend of 15 cents a share usually paid at this time of the year.

BOOK REVIEW.

Steam Turbines, by Lester G. French, Brattleboro, Vt. The Technical Press. 418 pages. 6 x 9 inches. Cloth. Supplied by THE IRON TRADE REVIEW for $3.00.

The author of this work, who for nine years previous to July, 1906, was editor of *Machinery,* had, in connection with his work on that paper, unusual opportunity to study the development of the steam turbine. Many of the articles and paragraphs which appeared in that publication are reproduced in the present volume in more or less modified form, although the greater quantity of the matter presented has been written especially for this work and has not been used before.

The book comprises 20 chapters, the first of which deals with steam turbine principles and illustrates impulse and reaction, dealing with the subject in a very elementary fashion. Steam nozzles are also discussed, the influence of different shapes of nozzles upon the jet being described and illustrated. The distinction between the impulse and reaction types of turbine is clearly drawn and examples of the different types presented. Chapter II reviews the early turbine patents and presents the essential claims of important patents. The following two chapters take up the simple impulse turbine and describe the De Laval turbine with its special applications, and also the Rateau, the Riedler-Stumpf and other machines. The next two chapters are devoted to compound impulse turbines of the multicellular type and the following chapter treats of reaction turbines describing the Parsons, the Westinghouse-Parsons, the Brown-Boveri and the Allis-Chalmers turbines, while chapter VIII is devoted to miscellaneous turbines and apparatus.

Chapter IX entitled, "Steam Turbine Performance," gives the records of a number of steam turbines with their efficiencies and also compares the steam turbine with the steam engine. The test records presented in this chapter cover a wide range of performance, and are especially valuable to anyone investigating the economy of the turbine. The following chapters of the book take up experiments on the flow of steam, the apparatus used and the work done by various experimenters being presented, steam and its properties, and calculations of the flow of steam. In the chapter on the calculations of the flow of steam, the principles of steam nozzle design are given, together with the method of procedure and design. Examples in the design of a diverging nozzle are also presented. Chapter XIV is devoted to turbine vanes, which are discussed both mathematically and graphically. Bodies rotating at high speed are the subjects of a separate chapter, which discusses in a very clear manner the peculiar action of an unbalanced turbine disc rotating at high speed about its center of gravity instead of its geometrical center. In this chapter the subject of balancing is discussed, and the methods and apparatus used by various manufacturers are presented. The remaining chapters of the book take up efficiency and design, the commercial aspect of the turbine, care and management of the turbine, condensing apparatus and the marine steam turbine. The book is replete with useful information, is well written and presents the subject in a logical and concise manner. The mechanical work is good, the illustrations being exceptionally well chosen and finely executed.

The Commonwealth Electric Co., which is controlled by the Chicago-Edison Co., has certified to the secretary of state of Illinois an increase in its capital stock from $10,000,000 to $15,000,000. The action was taken to provide for future requirements and to make available an amount of stock which the directors may see fit to sell at some future time.

CONCRETE ORE DOCK.

Cleveland Furnace Co. Will Make Extensive Improvements.

One of the first reinforced concrete docks to be built for ore docking is now in process of construction at the plant of the Cleveland Furnace Co., Cleveland, on the Cuyahoga river. The dock, which has been designed and is to be built by the Carey Construction Co., Cleveland, is one of the many improvements now being undertaken on the river to provide better facilities for handling the ore at that port. At present the Cleveland Furnace Co. maintains an unloading plant and dock near the mouth of the river where the dock is accessible to boats and from that point the ore must be transported in cars by rail to the furnace much farther up the river and again unloaded into the yard where it is kept in stock. According to present plans, the river channel is to be deepened to permit of navigation as far up as the Cleveland furnace, and in consequence, the company is now improving its dock facilities at its plant, so that the ore may be unloaded directly from he boats to the stockpile.

This means that the river front at that point must be filled in and a dock built, so that there will be sufficient depth to accommodate the draught of the ore carriers. The design of the reinforced concrete work is shown in the accompanying drawing, and as indicated, 14-inch wooden piles tapering to 6 inches have been driven as the

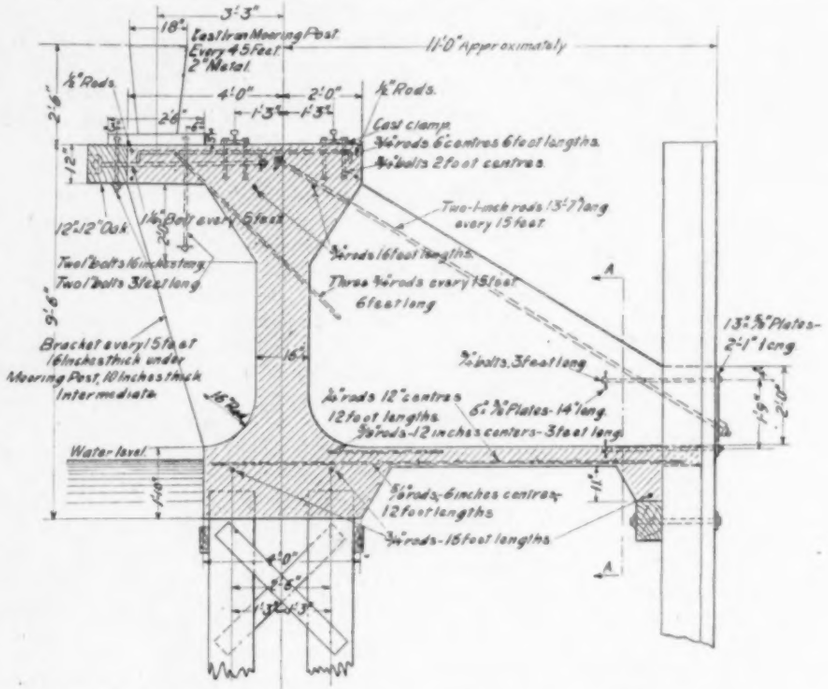

Cast Iron Mooring Post Every 45 Feet 2" Metal
11'0" Approximately
1¼" Rods
1¼" Rods
Cast clamp
¾" rods 6' centres 6 foot lengths
¾" bolts 2 foot centres
12"x12" Oak
1½" Bolt every 6 feet
Two-1-inch rods 13'-7" long every 15 feet
¾" rods 16 foot lengths
Two ¾" bolts 3 feet long
Three ¾" rods every 15 feet 6 feet long
Bracket every 15 feet 16 inches thick under Mooring Post, 10 inches thick Intermediate
¾" bolts, 3 feet long
¾" rods 12" centres 12 foot lengths
6"x⅜" Plates-14' long
¾" rods-12 inches centers-3 feet long
Water-level
¾" rods, 6 inches centres 12 foot lengths
¾" rods-15 foot lengths
13"x⅜" Plates-2'-1" long
A
A

FIG. 1.—CROSS SECTION OF CONCRETE ORE DOCK.

supporting foundation. These piles are in alluvial soil with the exception of 4 feet of slag fill on the surface. The existing dock on which the concrete work must be built consists of a line of sheet piling approximately 11 feet back of the new center line of the rails on which the unloading machine will run. Back of this sheet piling is an earth fill through which run rods tying the sheet piling to 20-foot anchor piles. Anchorage to the old dock is obtained, as indicated in the drawing, shown in the sketch indicating the location of the runway, and to stand a wheel load, including the wind load, of 53,000 pounds, the wheels being 2 feet 6-inch centers. A possible condition has to be provided for, however, where four wheels 4 feet centers are all on the dock at one time. Web reinforcement is also provided to take up the shock from the wooden bumper caused by boats striking the dock in landing. The space between the new concrete dock and the old sheet

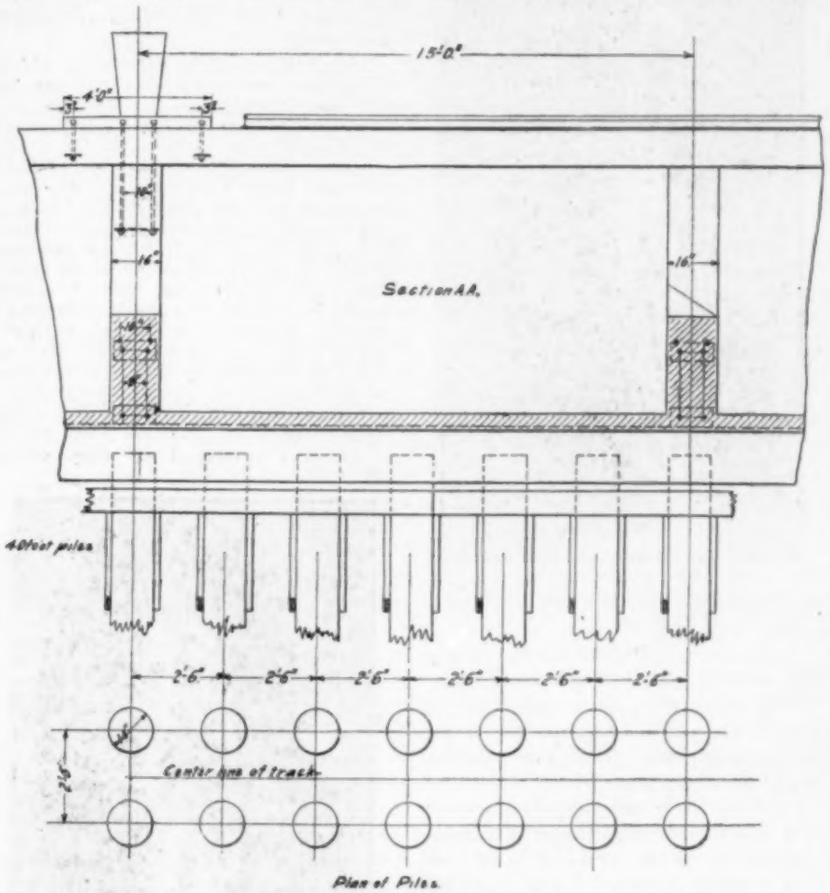


FIG. 2.—PLAN AND SECTIONAL ELEVATION OF CONCRETE ORE DOCK.

through 16-inch reinforced concrete webs spaced every 15 feet and tied to the sheet piling, and will take care of whatever outward thrust is put upon the dock by the ore piles loaded on it.

Wooden piling has been used instead of concrete, because of the initial cost, a difference in favor of wood of about $6 per foot existing between the two designs. The difference between the strengths of the two forms of construction is indicated by the fact that a concrete pile has a 21-inch bearing surface at the top and is 32 feet deep to carry the same load as the wooden pile 14 inches in diameter and 42 feet deep. As shown, the piles are to be driven with 2 feet 6-inch centers.

The dock is designed to carry one end of the unloading plants, the rails piling is to be filled with slag. This slag filling and the slag sand for the concrete, which is to be a 1, 2, 4 mix, is furnished by the Cleveland Furnace Co. at a cost of 25 cents per yard. A considerable reduction in cost will result, therefore, as this is cheaper than ordinary sand, which costs about $1.30 per yard. The entire cost per foot of the dock is $25.70, which includes the price paid to the furnace for the sand, cost of piling and 12 x 12-inch oak bumpers. While the wooden piling has been guaranteed to stand the load, its guaranteeing is not assumed by the concrete builders and does not enter into the guarantee for the concrete work. However, there is no reason for anticipating the failure of the wooden piling and the reduced cost is a considerable item.

The present dock is to be 1,000 feet long, and, in the event of its success, will probably be followed by the building of added sections. Cast iron mooring posts with 2-inch metal have been located every 45 feet and the surface of the dock is 7 feet 8 inches above the ordinary water level. Such a dock presents features of low cost, largely due to its design, strength and durability and there is every reason for looking to a larger use of reinforced concrete for similar purposes in the future.

BELGIUM'S TECHNICAL POWER.

"The kingdom of Belgium, with an area of about 11,000 square miles, and a population of 7,000,000, presents an example of what a technical education coupled with a native thrift will accomplish," reports Consul J. C. McNally of Liege. "The country's expansion has been rapid, and its industrial and commercial progress places Belgium in the fifth place of the world's producing nations. For the first six months of 1906 Belgium exported articles to the value of $231,535,575, an excess of $32,000,000 over the same period of 1905. This was due to the capacity of the producers to manufacture in a way successfully to compete with foreign competitors in the open markets of the world. This general capability extends from the director of the factory to the smallest employe. The elements that enter into this capacity are a prime quality, a continued output, and the power of the artisan to produce at the lowest possible cost. Nor is this standard of usefulness the result of accident. The government, in full appreciation of the fact that upon the nation's exportations depends its prosperity, joins hands with the various industries, and by every material assistance, judicious legislation and the creation of technical institutions, opens new markets, helps the production and establishes a high standard of skilled labor. The prosperity of Belgium, which is advancing rapidly from year to year, is undoubtedly due to the technical teaching, which is prominent in the diversity and numbers of its institutions. These schools, created and maintained by the government, are under the general supervision of the department of commerce and labor, which appoints a board of general supervisors whose duty it is to see that the teaching is of a high standard, as well as to oversee the sanitary and hygienic arrangements of the various schools."

SOME LARGE POWER TRANSMISSION WHEELS.

Until very recent years commercial limitations were such that the demand for large sized gears, rope sheaves,, pulleys and other power transmitting machinery had been small.

With the gradual introduction and development of large power units and heavy machinery as well as extensive industrial installations has justified not only an increased demand for all power transmitting apparatus but has made necessary the use of larger sizes of the transmission medium mentioned above.

The accompanying cuts illustrate the progress made along these lines. The subjects of these illustrations represent the product of the Mesta Machine Co., Pittsburg. This concern has recently established and equipped, with a representative personnel, a separate and distinct department for the design and manufacture of machinery for power transmission. For this purpose the company's already extensive foundry and manufacturing facilities are being increased.

The large rope sheave shown in Fig. 1 is one of three sections forming a complete wheel 24 feet diameter, with 14 feet ¾ inch total face, operating at a speed of 70 revolutions per minute.

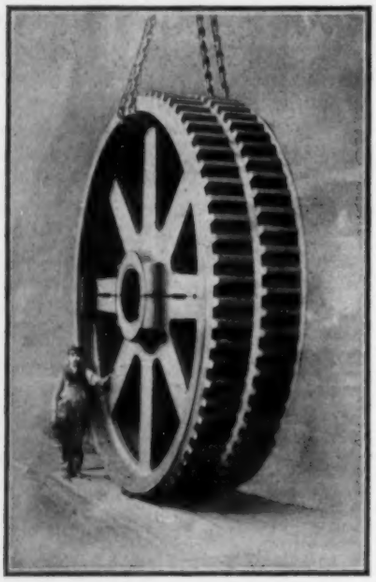


FIG. 2.—14-FOOT, 8-INCH PITCH GEAR.

The complete wheel was designed with 60 grooves to accommodate sixty 2-inch ropes.

The bore for the shaft is 32 inches. The weight of the section as shown is 90,000 pounds, or a total weight for the wheel of 270,000 pounds. The material entering into the construction of the wheel is a superior grade of air furnace cast iron of high tensile strength. This wheel was built for the National Tube Works of the United States Steel Corporation at McKeesport. Additional rope wheels with a total finished weight of 726,000 pounds were furnished the same company as follows:

One 24-foot and two 20-foot wheels made in two sections each. The 24-foot and one 20-foot wheels were designed with 12 grooves in each section, while the remaining 20-foot wheel was

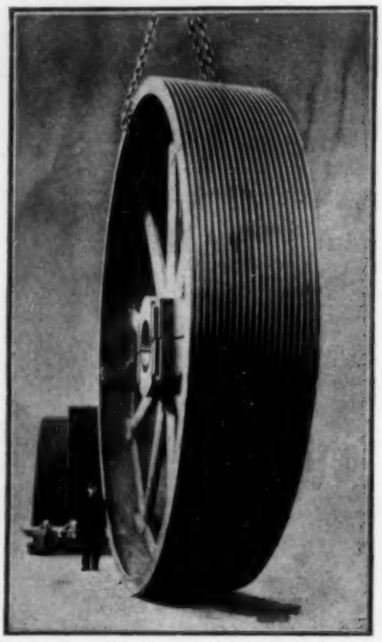


FIG. 1.—24-FOOT ROPE DRIVE SHEAVE.

designed with 18 grooves per section. All were built for 2-inch rope.

The gear illustrated in Fig. 2 was designed for the Allegheny Steel Co., Brackenridge, Pa. This gear was also made of a high grade of air furnace cast iron and cast in two parts, the teeth being machine molded. The two halves are secured by shrink links and fitted bolts, the abutting surfaces being machined. The gear is 14 feet 10¼ inches pitch diameter, 8 inches circular pitch, with staggered teeth, 70 in each row. The face of each tooth is 16¼ inches and the total face over the shrouds is 3 feet 7 inches. The bore for the shaft is 24 inches diameter. The total finished weight of the gear is 80,000 pounds.

Fig. 3 illustrates a band wheel or pulley furnished with a 20 x 42-inch Corliss engine built for the Alma Mfg. Co., Baltimore. The wheel is 14 feet diameter by 33 inches face and weighs 18,000 pounds. On a Corliss engine 24 x 48 inches built for the C. J. Matthews Co., Philadelphia, Pa., was furnished a band wheel 18 feet diameter by 38-inch face. This wheel has ten arms instead of eight as shown in Fig. 3. The total weight was 27,000 pounds. The 14-foot wheel was designed for running at a speed of 75 to 100 revolutions per minute, and the 18-foot wheel for running at a speed of 80 revolutions per minute.

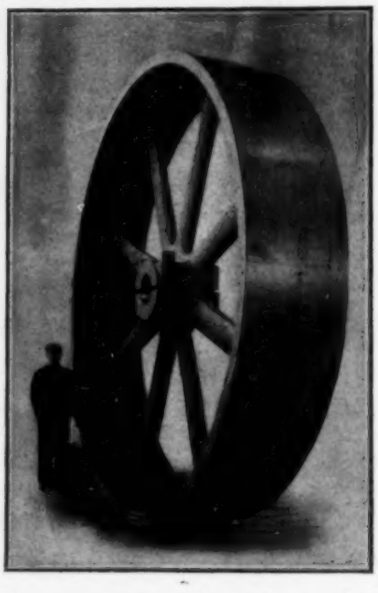


FIG. 3.—14-FOOT BY 48-INCH BELT WHEEL.

WILL HOLD CONFERENCE.

At a meeting of the executive council of the National Civic Federation at New York recently to consider the advisability of calling a conference to take up the question of federal and state regulation of trusts and corporations, on the lines of a convention held in Chicago under its auspices in 1899, it was decided that the meeting should be called. The following statement was issued:

The National Civic Federation which called the trust conferences of 1899 in Chicago, has decided to arrange another conference of the same nature to consider that problem in its latest aspects; especially the question of federal and state regulation of the corporations, and the question of the operation of the Sherman anti-trust law. It is proposed to hold this conference in May, at a city to be designated later. The governors of the various states are to be invited to appoint delegates, and the leading commercial, agricultural, labor, economic and bar associations of the country will also be represented.

The conference is intended to give opportunity for full and free discussion of the subject by men of all shades of opinion, with the hope that the outcome will be practical and constructive recommendations.

All the conferences held under the auspices of the federation have been conspicuous for bringing together in fair discussion every section of the country and every point of view, with valuable educational results. It is hoped that this conference, held at this time, will lead the way to a better understanding between the conflicting interests and an ultimate solution satisfactory to the country.

THE ART OF CUTTING METALS[1]

(Continued from last week.)

By Fred W. Taylor.

TOOL STEEL AND ITS TREATMENT.

Among modern experiments upon the chemical composition and the heat treatment of tools with relation to their cutting speeds, the experiments made by the firm of Armstrong, Whitworth & Co., England, would seem to rank in thoroughness next to those made by Mr. White and the writer at the Bethlehem Steel Works.

In a paper entitled "The Development and Use of High-Speed Tool Steel" (published in the Journal of the Iron and Steel Institute, October, 1904), Mr. J. M. Gledhill, managing director of Armstrong, Whitworth & Co., has given a brief account of these experiments. The opening paragraphs of this paper present such a concise and interesting historical sketch of the development of tool steel and its treatment that the writer takes the liberty of quoting them as follows:

"It would doubtless have been felt by many but a few years back that there was little left to be said on the subject of crucible tool steel, and that something akin to finality had been arrived at in its manufacture and general treatment. Probably such feeling was justifiable when it is remembered that the making of steel in crucibles is by far the oldest method known, dating back from time immemorial, it being indeed impossible to accurately trace its origin and earliest development, but it seems certain that carbon steel was made and used thousands of years ago for cutting tools. Proof of this may be seen by the marvellous carvings and workings on the intensely hard stone work of the ancients, for it would be difficult to conceive by what means, other than with steel tools, such work could have been executed, and it is wonderful to contemplate that steel-cutting tools should have been used so long ago, whilst the principle of manufacturing them—that is, by fusion of iron and charcoal in crucibles—was then in a measure on the same lines as we work on at the present day. Archaeologists have discovered that the Chinese made steel in crucibles before the Christian era.

"'Wootz' steel fabricated in India centuries ago was crucible steel, as was also the celebrated Damascus steel, produced at the forges of Toledo. Curiously, this latter steel furnishes yet another proof that there is nothing new under the sun, for it is recorded that Damascus steel contained certain percentages of tungsten, nickel, manganese, etc., some of the very elements, in fact, contained in the present modern high speed steel, so that a latent high speed steel may be said to have existed centuries ago, and all that was necessary to bring out its inherent powers would have been the heating of it in a paradoxical manner, so to speak; that is, to such a high degree of temperature as was long thought would impair or destroy the nature of such steel. When, therefore, we look back on the period for which crucible steel has been known in the world's history, some may not unnaturally think that there has been time enough to have fully fathomed its mysteries, leaving little more to be said on the subject. It is then all the more remarkable that a discovery, made but a few years back, and which has since revolutionized the treatment of crucible tool steel, should have remained so long a hidden secret.

"A very important advance was made 30 or 40 years ago, when 'Mushet,' or self-hardening steel, was introduced. This was the valuable invention of Robert Mushet, who, after a long series of experiments, made whilst he was manager of the Titanic Steel Co., succeeded in producing a tungsten steel, and its introduction was a great advancement on the cutting powers of ordinary crucible steel and for many years 'Mushet' steel held a foremost place amongst tool steels.

"It is now to America, however, that all honor must be given for the next great step in having 'set the pace' and led the way in the present remarkable advancement in tool steel, and the author would here like to record that the greatest credit is due to Messrs. Taylor and White, who at the Bethlehem Steel Works, initiated high-speed cutting, and at the exhibit of their firm in Paris some years back, what were then considered to be astonishing results in speeds of cutting steel were publicly demonstrated. Since then, still greater developments have been made by the author's firm in high-speed steels, and with increased experience in its manufacture, treatment, and application in our workshops, results in cutting powers far beyond expectation have been attained."

Ordinary Tool Steel.

For centuries steel weapons, knives, tools and implements used in cutting metals have been made from tool steel which in its chemical composition consists mainly of the two elements of iron and carbon—carbon to the extent of say from ¾ of 1 per cent to 1½ per cent—and the rest of the steel consists practically of iron. In addition to these two elements, however, tool steel has contained in small quantities several other ingredients, among which manganese and silicon may be classified as useful elements; i. e., elements which facilitate melting and forging, and which by their presence improve the properties of the steel in its finished state. In addition to these elements very small percentages of phosphorus and sulphur are always present. These latter may be described or classified as impurities. Phosphorus is particularly injurious, as it causes brittleness in the finished steel known as "cold shortness." Sulphur renders the steel difficult to work while hot, and this is known as "red shortness." This tool steel which has been in use for centuries past and which, broadly speaking, consists mainly of a combination of carbon and iron, is now known as "carbon tool steel" or "ordinary tool steel."

Hardening.

Tools and implements made from this steel, however, are entirely too soft as they come from the forge for almost all cutting purposes. In order to prepare them for cutting, they must be hardened, and this is done by heating them to temperatures in accordance with their carbon contents, varying between a dark and a bright cherry red, say, from 1350 degrees Fahr. (735 degrees Cent.) up to 1550 degrees Fahr. (845 degrees Cent.), and then by plunging them quickly into water or other suitable bath, cooling them very rapidly to a temperature not exceeding 392 degrees Fahr. (200 degrees Cent.), or preferably to the normal temperature of the air. This operation is called "hardening."

Tempering.

When cooled suddenly in this way, implements and tools made from carbon tool steel are too brittle for most cutting purposes. This quality of brittleness is removed or modified by reheating to temperatures ranging between 392 degrees Fahr. (200 degrees Cent.) and 600 degrees Fahr. (315 degrees Cent.). The higher the tool is re-

[1]Presidential Address, A. S. M. E., 1906.

heated within these ranges of temperature, the softer it becomes, and this reheating for the purpose of partially softening and at the same time toughening the tool is the operation known as "tempering the tool."

Ordinary Tool Steel.

The two operations of hardening and tempering implements made from tool steel are by no means simple. They have been the subject of a vast amount of experimenting and investigation for many years and in themselves constitute whole trades.

The chief difficulties in hardening come from three causes:

(A) Each ordinary tool steel, depending upon its chemical composition, has a particular temperature at which a radical change takes place in the condition of the carbon which is contained in it. This temperature known as the "refining point," "critical point," or "point of recalescence" of the steel, will be briefly referred to later in the paper. In order to obtain the best results in hardening, the steel should be uniformly heated to slightly above this critical point. If heated below the critical point, it fails to harden when plunged into water. On the other hand, the higher the temperature to which it is heated above the critical point, the coarser will be the grain with increased weakness and brittleness after being plunged into water. This overheating of carbon steel tools to temperatures too high above the critical point has been in the past perhaps the most frequent cause of their failure.

(B) The second difficulty lies in not heating the tools uniformly. A lack of uniformity in heating will produce irregularity in the degree to which the tool is hardened, some portions being much harder than others after quenching, and this sets up severe internal strains in the tool, frequently developing into water cracks.

(C) The third difficulty lies in properly cooling the tool in the water or quenching medium. Uneven or irregular cooling also produces severe internal strains often resulting in water cracks.

The correct tempering of tools presents also many difficulties. In most cases it is desirable to temper tools or implements so that the cutting portion shall remain exceedingly hard while the body is softened, and thereby made sufficiently tough to give it the required strength. This necessary combination of toughness and hardness calls for great skill and judgment in the reheating or softening operation known as "tempering."

One of the greatest advantages of modern high-speed tools over the carbon tools lies in the fact that they require far less knowledge and skill in their heat treatment than was demanded by the carbon tools.

Mushet or Self-Hardening Steel.

Some time between 1860 and 1870, Robert Mushet made the discovery that if a considerable amount of tungsten was added to tool steel in combination with a larger percentage of manganese than had been used before, the presence of these two elements with carbon in the steel produced the curious effect of causing the tool to be almost as hard when cooled slowly in air from a forging heat as carbon tools when cooled in water. Because of this peculiar property, the Mushet tools were called in England self-hardening tools and later in this country air-hardening tools.

The chemical composition of the Mushet tools as analyzed by us in the early part of 1905 follows:

MAKE OF STEEL	TUNGSTEN, PER CENT	CHROMIUM, PER CENT	CARBON, PER CENT	MANGANESE, PER CENT	VANADIUM, PER CENT	SILICON, PER CENT	PHOSPHORUS, PER CENT	SULPHUR, PER CENT	SPEED PER MINUTE IN FEET CUTTING MEDIUM STEEL
Jessop	.....	0.207	1.047	0.189	....	0.206	0.017	0.017	16
Mushet self-hardening	5.441	0.398	0.15	1.578	....	1.044	.....	.....	26
Original Taylor-White	8.00	3.80	1.85	0.30	....	0.15	0.25	0.030	58 to 61
Best modern high speed, 1906..	18.91	5.47	0.67	0.11	0.29	0.043	.....	.....	99

Four Epochs in History of Steel Tools, With Analyses of Tools of These Eras.

We give below the chemical analyses of four tools which are typical of the various steps or eras in the development of metal cutting tools:

Chemical Analysis of Typical Tools.

The first of these is the analysis of perhaps the most noted brand of ordinary carbon steel, that made by Messrs. Jessop & Sons of England, which is typical of the era of carbon tools. The second is the analysis of the old fashioned Mushet self-hardening steel as experimented with by us in 1894-95 — typical of the era of self-hardening tools. The third is the analysis of the steel recomended by us in our patent 668270 of February 19, 1901, as being, on the whole, the best at the time when modern high speed tools were invented by Mr. White and the writer, marking the beginning of "high speed" or "red hardened" tools. The fourth is the analysis of the best high speed tool, so far as we know, which has been developed up to the end of the summer of 1906.

For many years the tool steel developed by Mushet was looked upon largely as a curiosity. Gradually, however, the managers of machine shops found that by using tools made from the Mushet steel they were able to cut hard forgings and castings which were difficult to cut with the carbon tools. When this knowledge became quite general, it was usual for the best machine shops to have a few Mushet tools on hand for use on specially difficult work, and their use for this purpose grew steadily from year to year.

It was not, however, until about 1890 that there was at all a general awakening among managers of machine shops as to the whole question of the cutting speeds of tools, and it may be said that practically up to that time Mushet tools had not been used for the purpose of gaining an increase in cutting speed.

Experiments Comparing Mushet and Other Self-Hardening and Carbon Tools.

It was in 1894 that we first had the opportunity to make a careful series of experiments to determine the relative cutting speeds of the Mushet and the carbon tools. We had hitherto been prevented from doing so by the fact that the Midvale Steel Works manufactured and sold tool steel, and up to the time the writer left its employ, it had not gone into the manufacture of self-hardening steel, and therefore would not allow us to make any experiments with it.

Our experiments in 1894-95 resulted in the following important discoveries:

a That, comparing the self-hardening steel with carbon steel, a gain in speed of 41 per cent to 47 per cent could be made in cutting a hard forging of about the quality of tire steel; whereas a gain of nearly 90 per cent could be made in cutting the softer qualities of metal, and

b that by using a heavy stream of water on the nose of a Mushet or other self-hardening tool, a gain of about 30 per cent could be made in the cutting speed.

These experiments, then, indicated clearly that the use of Mushet steel almost exclusively for cutting exceedingly hard pieces of metal was the wrong one; since an enormously greater percentage of soft metal was cut in the average machine shop than of hard metal, and the gain in cutting soft

metals was 90 per cent as against only a 45 per cent gain for hard. It thus became evident that instead of using self-hardening tools only occasionally for cutting extra hard pieces of metal, they should be used daily throughout the shop on all ordinary work in place of the carbon steel tools. From that time on the increase in the use of self-hardening steels was so very great that at the time of our invention of the new high speed tools, probably from one-fourth to one-fifth of the roughing tools used in good machine shops had come to be made from self-hardening steel.

Between 1885 and 1895 a few manufacturers of tool steel started to imitate the Mushet steel, and in the latter part of this period it was discovered that by substituting chromium for manganese in combination with tungsten a good self-hardening or "air-hardening" tool could be made. After 1890 the competition in the manufacture of self-hardening tool steels grew much more keen; but it is a remarkable fact that the successors to Mushet in the tool steel business, even up to the time of the Taylor-White invention, probably retained one-half of the business in self-hardening tool steel throughout the world. This is an unusual record for any one firm in the manufacture of any standard article.

As described in Part I[1], at the time that we discovered the beneficial results from heating chromium-tungsten tools near to the melting point, tools made by several makers of tool steel, containing largely chromium and tungsten as the self-hardening elements in place of the manganese and tungsten used by Mushet, had equaled in cutting speed the Mushet self-hardening tools.

Up to 1894 may be called the era of carbon tools. From 1894 to 1900 when high speed cutting tools, treated by the Taylor-White process, were exhibited at the Paris Exhibition may be called the era of Mushet or self-hardening roughing tools. From 1900 up to the present time may be called the era of high speed tools, and this has become so completely the case that at the present time a carbon or an "untreated" tungsten-manganese or tungsten-chromium roughing tool can scarcely be found in an up-to-date machine shop.

Nature of the Invention of Modern High Speed Tools.

The writer has already described the circumstances leading up to the discovery of the facts embodied in the invention of modern high speed tools. There exists in the minds of most users of these tools a serious misapprehension both as to the nature of the invention and also as to that property in high speed tools which chiefly gives them their value. Perhaps at least four out of five writers upon the subject of high speed tools speak of the "discovery" or "introduction of high speed tool steels," as though our invention consisted in the discovery of a tool steel new in its chemical composition. The fact is, however, that tool steel of excellent quality for making high speed tools existed and was in common use several years before our discovery was made.

The Quality of "Red Hardness."

A second misapprehension exists on the part of most people as to the nature of that property which enables the "high speed" tools to be run at their high speeds. Heating these tools (in a revolutionary manner) up close to their melting point is quite commonly referred to by writers on this subject as "hardening" the tools. In point of fact the high speed tools at their very hardest are little, if any, harder than the carbon tools, or the old fashioned self-hardening tools, and the quality of hardness is not that which enables them to run at very high speed.

FIG. 115.—TOOL POSSESSING PROPERTY OF RED HARDNESS.

This photograph illustrates the fact that red hardness, the distinctive property of high speed steel, differs materially from the property of hardness. This tool was run at high speed cutting a steel forging. The nicks close to the portion of the cutting edge which did the work were filed in it afterwards with an ordinary file, and showed the tool to be soft in spite of its possessing a high degree of red hardness.

Heating chromium-tungsten tools close to the melting point does not give them a degree of hardness which is unusual in tools, but it does give them the entirely new and extraordinary property of retaining what hardness they have, even after the tool has been heated up in use through the pressure and friction of the chip, until it is almost, or quite, red hot. This new property in high speed tools has been very appropriately named "red hardness," because the tool maintains its cutting edge sufficiently sharp and hard to cut steel even after its nose is red hot, and because in many cases it heats up the chip or shaving which it is cutting until the portions of the chip which are exposed to the friction of the tool become red hot.

The fact that hardness of the kind to which we have been accustomed in ordinary tools has but little to do with high speed tools is graphically illustrated in Fig. 115. This is one of the high speed tools of the most approved chemical composition referred to on page 504, THE IRON TRADE REVIEW, Mar. 28, 1907, and this very tool was run at as high a cutting speed as the high speed cutting tools originally developed by us. After running at its high speed, the two deep indentations or nicks were filed with a file made from ordinary carbon tool steel, one across the cutting edge and the other about ½ inch below the cutting edge, showing that a first-class high speed tool can be readily filed by the old carbon tool steel.

As to our invention, briefly speaking, by far the most important of the several discoveries made by us, and which led to the modern high speed tools, was the discovery that when tools made from tool steel, old in its chemical composition (containing not less than one-half of one per cent of chromium and not less than one per cent of tungsten, or its equivalent) were treated in a new and completely revolutionary manner to an extraordinary high heat (a heat so high that it would have utterly ruined ordinary tools), this treatment imparted an entirely new quality or property to a cutting tool, namely the property called "red hardness;" and it is this new property which enables these tools to run at their high cutting speeds.

General Comparison of the Ingredients of Carbon Tools, Self-Hardening Tools and Modern High Speed Tools.

Chemically speaking, the era of carbon tool steel may be said to consist of tools containing from ¾ per cent to 1½ per cent of carbon in combination with a little manganese and silicon, the rest of the steel being iron.

The era of self-hardening tools may be said to consist of tools containing about 4 to 11 per cent of tungsten in combination with 1½ per cent to 3½ per cent of manganese with 1¼ to 2¼ per cent of carbon; and to these ingredients chromium to the extent of from three-tenths of one per cent to almost 3 per cent was used either as a substitute for the manganese or in addition to it. The rest of the steel consisted of iron with a small amount of silicon used for melting purposes.

The era of high speed tool steel may be said to consist of tools containing one-half of one per cent or more of chromium in combination with one per cent or more of tungsten, or its equivalent of molybdenum heated almost to the melting point. The percentages of

[1]IRON TRADE REVIEW, Dec. 13, 1906.

chromium and tungsten used in high speed tools vary between extremely wide limits. The "one-half per cent or more" of chromium referred to in our patent has been increased in the extreme case to the extent of 7 per cent, and the "one per cent or more" of tungsten has been increased in the extreme case to 26 per cent. The percentage of carbon, on the other hand, has been lowered until the better modern tool steels contain from fifty-five one-hundredths of one per cent to about 1¼ per cent as the maximum, and the manganese, silicon and other ingredients have been reduced to quantities sufficient merely for good melting. As above explained, molybdenum has been substituted for the tungsten as an equivalent or mixed with the tungsten. Our experiments, however, would indicate that this element is not as desirable as tungsten.

Addition of Vanadium in Small Quantities Improves Quality of High Speed Tools.

During the year 1906 our experiments indicate that the addition of a small amount of vanadium, from twenty-five one-hundredths of one per cent to one-half of one per cent, chemically improves the quality of high speed tools, and the best chemical composition which we know of for high speed tools is the following, recently developed by us: Tungsten, 18.91; chromium, 5.47; carbon, 0.67; manganese, 0.11; vanadium, 0.29; silicon, 0.043.

General on the Treatment of High Speed Tools.

Seven years have now gone by since Mr. White and the writer applied for patents covering the Taylor-White process of making and treating tools, and it is an extraordinary fact that so far as the writer knows, not a single improvement has been made upon the method of heat treatment for producing the high speed lathe and planer and other metal cutting tools described in this patent.

During the summer and fall of 1906 we procured those makes of tool steel which have recently attained the highest reputation for efficiency in England, Germany and America, and have conducted a careful series of experiments with tools shaped and ground exactly alike, in cutting both steel and cast iron of uniform qualities, in order to determine both what chemical composition and what heat treatment would produce a tool of the highest cutting speed.

In all cases we obtained detailed instructions from the makers of the steels, telling us just what heat treatment to give tools made from their steels and in some cases men were sent by the manufacturers to superintend the heat treatment of their tools. In all instances we treated each brand of tool steel exactly as directed and then tested the tools to determine their fastest standard cutting speeds.

In addition to this, similar tools in most cases the same, made from each make of tool steel were treated in exact accordance with the method indicated in our patent 668269 of February 19, 1901, as our preferred method. And without an exception, the same make of tools, when treated in exact accordance with the directions given in our patent, proved more uniform and ran at slightly higher cutting speeds than when treated in accordance with the directions given by the makers.

This result is extraordinary, indeed we believe almost unique, in the history of an invention so fundamental and revolutionary in its character. Moreover, the writer must confess to the greatest surprise that although subject to innumerable experiments throughout the entire manufacturing world, the method of treating these tools should not have been radically improved during all these years.

For detailed directions as to that heat treatment which will give the best results in the new high speed tools, therefore, the writer refers all readers to the directions given in the patent above referred to. However, we will briefly recapitulate the most important directions for treating modern high speed tools.

First or High Heat Treatment for High Speed Tools.—Heating Tools Close to the Melting Point.

After the lathe or planer tool has been forged, as heretofore described[3] the entire nose of the tool should be slowly and uniformly preheated to a bright cherry red, allowing plenty of time so that the heat may penetrate thoroughly to the center of the tool and thus avoid danger of cracking from too rapid heating. From the bright cherry red up to the melting point, on the other hand, the tool should be heated as rapidly as practicable in an intensely hot fire until the nose begins to soften. In fact, if the extreme exposed portions of the nose are slightly fused no harm will be done. In this operation also thorough and uniform heating is necessary, and time should be given for the whole nose of the tool to arrive at a uniform temperature.

No method or apparatus should be used for giving the tools the high heat treatment which heats only a portion of the nose of the tool. The whole end of the tool from the heel to the lip surface should be uniformly heated to the same high heat.

If the fire gives a sufficiently intense heat, a tool of 2-inch x 3-inch body can be thoroughly and properly heated in three minutes from a bright cherry red up to the proper high heat. Without an especially designed furnace, however, it is difficult to obtain a sufficient uniform and intense heat to treat a tool of this size in three minutes. Smaller tools require from three-fourths of a minute upward, according to the intensity of the fire and the size of the tool, to heat from the cherry red to the high heat.

The writer wishes to again emphasize the importance of an intensely hot fire. Various methods for producing this high heat will be referred to later. If the nose of the tool is exposed to the high heat for too long a time, or if a fire is used which does not give an intensely hot flame, the extreme outside layers of the tool are sometimes slightly injured, probably through oxidation. Therefore, in designing cutting tools, where practicable, they should be forged so as to allow from 1-16 to ⅛ of an inch to be ground off at the first grinding. This will insure immediately a tool having the highest cutting speed.

Cooling High Speed Tools From the High Heat.

We later refer to a certain range of temperatures between 1,550 degrees Fahr., to 1,700 degrees Fahr., called the breaking down temperatures, and call attention to the fact that the old-fashioned self-hardening tools if heated to within this range of temperatures were seriously injured or broken down in their cutting speeds.

To get the best and most uniform results with high speed tools after their high heat has been given them, as above described, they should be cooled rapidly until they are below the breaking down point, or, say, down to or below 1,550 degrees Fahr. The quality of the tool will be but little affected whether it is cooled rapidly or slowly from this point down to the temperature of the air. After all parts of a tool from the outside to the center have reached a uniform temperature below the breaking down point, therefore, it is our practice sometimes to lay it down in any part of the room or shop which is free from moisture, and let it cool in the air, and sometimes to cool it in an air blast to the temperature of the air.

We have found the best method of cooling from the high heat to below the breaking down point to be that of plunging them into a bath of

[3] Iron Trade Review, Feb. 7, 1907.

JOSEPH WHARTON

red hot molten lead below a temperature of 1,550 degrees Fahr. We now plunge them into a lead bath maintained at a uniform temperature of 1,150 degrees Fahr., because the same bath is afterward used for reheating the tools to give them their second treatment. This bath should contain a sufficiently large body of the lead so that its temperature can readily be maintained uniform; and for this purpose we use preferably a lead bath containing about 3,600 pounds of lead.

The largest sized tool when plunged at the high heat into a bath of this size will not materially affect the temperature of the lead. If too small a lead bath is used and one tool after another is plunged into it from the high heat, before, say, the first tool plunged has been cooled uniformly to the temperature of the bath, the lead may possibly be heated to a higher temperature than it had originally, and this rise in the temperature of the lead, if it were to extend beyond 1,240 degrees while the tool is in it, would seriously injure the tool.

Too much stress cannot be laid upon the importance of never allowing a tool to have its temperature even slightly raised for a very short time during the process of cooling down. The temperature must either remain absolutely stationary or continue to fall after the operation of cooling has once started or the tool will be injured. Any temporary rise of temperature during cooling, however small, will injure the tool. This, however, applies only to cooling the tool to the temperature of about 1,240 degrees Fahr. Between the limits of 1,240 degrees and the temperature of the air the tool can be raised or lowered in temperature time after time and for any length of time without injury. And it should also be noted that during the first operation of heating the tool from its cold state to the melting point no injury results from allowing it to cool slightly and then be reheated. It is from reheating during the operation of cooling from the high heat to 1,240 degrees Fahr. that the tool is injured.

The above described operation is commonly known as the first or high heat treatment.

To briefly recapitulate, the first or high heat treatment consists of heating the tool:

a slowly to 1,500 degrees Fahr.;

b rapidly from that temperature to just below the melting point;

c cooling fast to below the breaking down point, i. e., 1,550 degrees;

d cooling either fast or slow from this point to the temperature of the air.

The Second or Low Heat Treatment.

This treatment consists in reheating the tool which has had the high heat treatment to a temperature somewhere between 700 and 1,240 degrees Fahr., rather better results being obtained at the higher temperatures within these limits.

For this reheating the best practice is to place the tool in a lead bath containing about 3,600 pounds of lead, the temperature of which can be maintained uniform within a few degrees of 1,150 degrees Fahr. by means of an exceedingly simple optical pyrometer, and then either cooled in an air blast or laid down to cool in the air. The tool should be held in this bath about 5 minutes. To avoid danger of fire cracks, particularly if the tool is of complicated shape, it should be heated rather slowly before being plunged into the lead.

We have fixed upon 1,150 degrees as the temperature of the lead bath because, even with a sluggish bath slow in either increasing or lowering its temperature, there is danger through carelessness on the part of the operator of allowing its temperature to rise, and so heating the tool beyond the critical temperature of 1,240 degrees. If the tool is allowed even for a short space of time to rise in temperature beyond 1,240 degrees its property of red hardness will be seriously impaired, and its cutting speed greatly reduced; and a rise in temperature beyond 1,350 degrees will completely destroy the property of red hardness in the tool and leave it in its original condition before receiving the high heat treatment.

To briefly recapitulate, the second or low heat treatment consists of heating the tool:

a to a temperature below 1,240 degrees, preferably to 1,150 degrees for a period of about 5 minutes; and

b cooling to the temperature of the air either rapidly or slowly.

The good effects of the second or low heat treatment can be produced in another way, by running the tool under the friction of the chip until the temperature of its nose has been raised to within the limits of, say, 700 degrees, to 1,240 degrees Fahr. Having been heated under the pressure of the chip in this manner, and then cooled to the temperature of the air, the next time that it is run the tool will have a materially increased degree of red hardness and can be run at a higher cutting speed than it was capable of maintaining after the high heat and before the low heat treatment.

Uniformity the Most Important Quality in Cutting Tools.

The writer has many times referred to the necessity of uniformity in the various standards adopted, and we therefore consider uniformity in the red hardness of tools and in their cutting speeds to be the most important element or property to be sought for.

Within one month after having discovered the Taylor-White process we had succeeded in developing a number of tools which were capable of running at as high speeds in cutting steel of medium and soft quality and of lasting as well as any tools developed by us up to the date of application for our patent. The greater part of the time given by us to the development of high speed tools was spent in the effort to obtain uniformity in the tools. The writer looks upon uniformity as of such importance that he does not hesitate to assert that with proper task management more work can be gotten out of a shop with the old fashioned uniform Mushet tools than from a shop without task management and with new high speed tools which are as far from being uniform as they now are in many shops.

Under task management it is of great importance that the workman be fully convinced that the man who operates the slide rule and gives him his speed directions is able to tell him with regularity how to remove metal faster than he could remove it without these directions. Without uniform tools, however, the slide rule man will find himself almost as much at sea as the workman, and thus will be completely discredited in the eyes of the latter.

It is then for the purpose of obtaining uniformity in the tools that our method and apparatus described above for the high and low heat treatments are particularly desirable. It is a very curious fact connected with the development of high speed tools that there are a great number of ways of giving the high and low heat treatments which will produce first class tools. Perhaps three out of four tools given the high and low heat treatments in these various ways might be called first-class tools. Our method as described above, however, will produce tools which are practically all first-class, and it is for this reason that we recommend its adoption in all shops in which a sufficient number of tools are treated each day or each week to warrant the expense of maintaining lead baths controlled by accurate pyrometers and a proper furnace for giving the high heat.

It would be manifestly improper for the writer to describe in minute detail the apparatus developed by us for this purpose, because some features of the apparatus were patented, while others were mere questions of proportions and design, and the whole of the patents, apparatus and methods, were

sold by us to the Bethlehem Steel Co., after making the invention.

Little Attention Need be Paid to the Special Directions Given by Makers of High Speed Tools for Their Treatment.—All Good High Speed Tool Steels Should be Treated in the Same Simple Way.

For some years past it has been rather amusing to us to hear the special directions given by the various manufacturers of steel suitable in chemical composition for making the high speed tools. Very frequently a tool steel maker implies, or directly states that the chemical composition of his particular high speed tool steel requires "special treatment." The fact is, however, as stated above, that our recent experiments demonstrate beyond question the fact, that no other method which has come to our attention produces a tool superior in red harness (i. e., high speed cutting ability), or equal in uniformity to the method heretofore described. This applies to all makes of high speed tool steels which are capable of making first-class tools, whatever their chemical composition.

It is the writer's belief that duing our long series of experiments at the Bethlehem Steel Co. in our search for uniform tools and for the method of imparting the highest degree of red hardness to tools, we tried substantially every method which since that time has come to our attention.

For instance, in giving the tools the high heat we heated them in a blacksmith's coke fire, a blacksmith's soft coal fire, in muffles over a blacksmith's fire, and in gas heated muffles. We also constructed various furnaces for this purpose. We heated the tools by means of an electric current, with their noses under water, and out of water, and by immersion in molten cast iron. Moreover, by every one of these methods we were able to produce a first-class tool provided only the tool was heated close to the melting point.

In cooling from the high heat we experimented with a large variety of methods. After being heated close to the melting point, tools were immediately buried in lime, in powdered charcoal, and in a mixture of lime and powdered charcoal; thus they were cooled extremely slowly, hours being required for them to get below a red heat. And we wish to clearly state the fact that tools cooled even as slowly as this, while they were in many cases quite soft and could be filed readily, nevertheless maintained the property of "red hardness" in as high a degree as the very best tools, and were capable of cutting the medium and softer steels at as high cutting speeds as the best tools which were cooled more rapidly; and which were much harder in the ordinary sense.

Tools were also cooled from the high heat in a muffle or slow cooling furnace with a similar result. On the other hand, we made excellent high speed tools by plunging them directly in cold water from the high heat, and allowing them to become as cold as the water before removing them. Between these two extremes of slow and fast cooling; cooling in lime, charcoal, or a muffle, on the one hand, and in cold water, on the other; other cooling experiments covering a wide range were conducted. We tried cooling them partly in water and then slowly for the rest of the time; partly in oil, and then slowly for the rest of the time; partly by a heavy blast of air from an ordinary blower and the rest of the time slowly; partly under a blast of compressed air and then slowly. We also reversed these operations by cooling first slowly and then fast, as described. We also cooled them entirely in an air blast and entirely in oil, and then partly first in oil, afterward in water, and then first in water and afterward in oil.

By every one of these methods we were able to make a good high speed tool; i. e., a tool having a large degree of red hardness, and capable of cutting at very high cutting speeds. But by none of these processes were we able to obtain tools as uniform and regular as those produced by our lead bath and air cooling.

Best Method of Treating Tools in Small Shops.

There are many very small shops in which it is questionable whether the installation of the full apparatus required to treat tools by our preferred method would be warranted. For this class of shops, in treating high speed tools, the writer considers the best method to be as follows, for the blacksmith who is equipped only with the apparatus ordinarily found in a smith-shop:

After the tools have been forged and before starting to give them their high heat, fuel should be added to the smith's fire so as to give a good deep bed either of coke about the size of an English walnut or of first-class blacksmith's soft coal. A number of tools should then be laid with their noses at a slight distance from the hotter portion of the fire so that they may all be pre-heating while the fire is being blown up to its proper intensity. After reaching its proper intensity, the tools should be heated one at a time over the hottest part of the fire as rapidly as practicable up to just below their melting point. During this operation they should be repeatedly turned over and over so as to insure a uniform high heat throughout the whole end of the tool. As soon as each tool reaches its high heat, it should be placed with its nose under a heavy air blast and allowed to cool to the temperature of the air before being removed from the blast.

Unfortunately, however, the blacksmith's fire is so shallow that it is incapable of maintaining its most intense heat for more than a comparatively few minutes, and, therefore, it is only through these few minutes that first-class high speed tools can be properly heated in the smith's fire. Great numbers of high speed tools are daily turned out from smiths' fires which are not sufficiently intense in their heat, and they are therefore inferior in red hardness and produce irregular cutting tools.

Coke Fire Preferable to Soft Coal for Heating Tools Close to Melt-Point in Average Smith Shop.

On the whole, a blacksmith's fire made from coke may be regarded as better for giving the high heat to tools than a soft coal fire, merely because a coke fire can be more easily made by the smith which will remain capable for a longer period of heating the tools quickly to their melting points. We have, however, recently made some very careful experiments in which out of a lot of tools made from practically the same steel, each alternate tool was heated in the best type of coke fire and the best type of soft coal fire, and in every case a notably better tool was produced by the first-class soft coal fire. An improvement of fully 4 to 8 per cent was made by the soft coal over the coke tools. This is undoubtedly due to the fact that a first-class soft coal fire liberates large amounts of hydro-carbons which give an intense heat and are less likely to oxidize the steel than a correspondingly hot flame produced from coke.

Nevertheless, for the reasons given above, our advice is to use a coke fire and make it as deep as practicable. This is for the sake of securing uniformity. We have found it practically impossible to prevent smiths from giving tools their high heat in the soft coal fire long after the fire has passed that period of intensity which is suited to the high heat treatment. When the air blows through the fire and strikes the hot tool, it appreciably injures the outer layers of the steel to the depth of from 1-16 inch to 3-16 inch.

Cooling a tool in an air blast from high heat will produce as good and uniform a tool as can be made by any other method outside of that of plunging it into the hot lead bath. All of the more rapid methods of cooling the tool, either through plunging it into water or oil, render the tool more liable to fire cracks, and also more brittle in its body and liable to break in service, particularly when there is any lack of uniformity in

the heating, and at the same time cooling in water or oil gives no greater degree of "red hardness" than can be obtained through blowing in the air. And this applies without exception to all steel of the chemical composition suited to making the better modern high speed tools. No attention whatever need be paid to any other special directions given by the makers.

The one question about high speed tools which more than any other has been asked the writer for years past is: "Where can absolutely uniform high speed tool steel be bought?" and the writer's invariable answer has been: "Any one of the first-class makes of high speed tool steel is amply good. The trouble does not lie with the lack of uniformity of the tool steel. The main trouble is that you have not yet stolen the whole of the invention. You had better go back and steal it all."

Several types of apparatus have been developed for giving high speed tools their first or high treatment as well as for giving them their second or low heat treatment. For a description of some of these the writer would refer to Mr. Gledhill's admirable paper above mentioned, on "The Development and Use of High Speed Tool Steel," and also to an article by Messrs. O. M. Becker and Walter Brown in the *Engineering Magazine* for November, 1905.

Importance of Not Overheating High Speed Tools in Grinding.

The writer trusts that he has made the fact clear that the property of red hardness in tools is seriously impaired by even temporarily raising their temperature beyond 1,240 degrees Fahr. He ventures to say that fully half of the high speed tools now in use in the average machine shop have been more or less injured, and are therefore lacking in uniformity, owing to their having been overheated during the operation of grinding. Even when a heavy stream of water is thrown upon the nose of the tool throughout the operation of grinding, tools can be readily overheated by forcing the grinding or by allowing the tool to fit against the grindstone. This injury is all the more serious because there is no way of detecting it except by finding through actual use that the tool has become of inferior quality. The writer has frequently seen tools which were ground under a heavy stream of water heated so that the metal close to their cutting edges showed a visible red heat.

Occasionally tools are also overheated by running at too high speeds in the lathe. In this case, however, the injury to the tool is perfectly apparent, and therefore not so serious as the overheating on the emery wheel.

A tool which has been overheated either in grinding or in the machine can be again rendered first-class in quality by grinding it from 1-16 inch to 3-16 inch back from the cutting edge and down from the lip surface, because overheating from grinding or running in the lathe rarely penetrates beyond this depth.

The best advice that we can give to those desirous of having uniform tools is not to experiment with new brands of tool steel. Adopt once for all the best that can be had at the time the choice is made, and then see to it that the smith heats each tool uniformly and rapidly close to the melting point, and that the grinder does not overheat the tool in sharpening it. Watch the smith and the grinder, do not change the make of the tool steel.

(To be continued.)

FIRST COST OF MECHANICAL VS. CHIMNEY DRAFT.

J. H. Kinealy in his work "Mechanical Draft," says that it is extremely difficult to make a general comparison of the first cost of a chimney with that of a mechanical draft plant, because of the fact that most chimneys for power plants are usually put up with a view of obtaining a draft from 0.5 to 0.75 of an inch of water, while mechanical draft systems are seldom installed except to give a draft of not less than at least one inch. It is probable that most chimneys are between 100 and 150 feet high, while a chimney to give a draft of one inch would have to be between 175 and 200 feet high, and the cost of a chimney increases very much as the height is made greater than about 125 feet. Moreover, for a large power plant several small steel chimneys are often put up instead of one large brick chimney, and these chimneys may be of cheap steel construction, so that the cost may be small. Again, there is a curious difference between a chimney and a mechanical draft apparatus, that while a tall chimney to give a high draft costs more than a low chimney to burn the same quantity of coal under a low draft, a fan to supply air for a given quantity of coal under high draft, costs less than a fan for the same quantity of coal under a low draft. A low draft, however, means a low rate of combustion per square foot of grate surface, and hence a large area of grate in order to burn a given quantity of coal per hour, and it means also an almost total inability to burn coals of very low grade; while a high draft means a rapid combustion per square foot of grate surface, and hence a small grate to burn a given quantity of coal per hour, and also the ability to burn cheap coals of low grade.

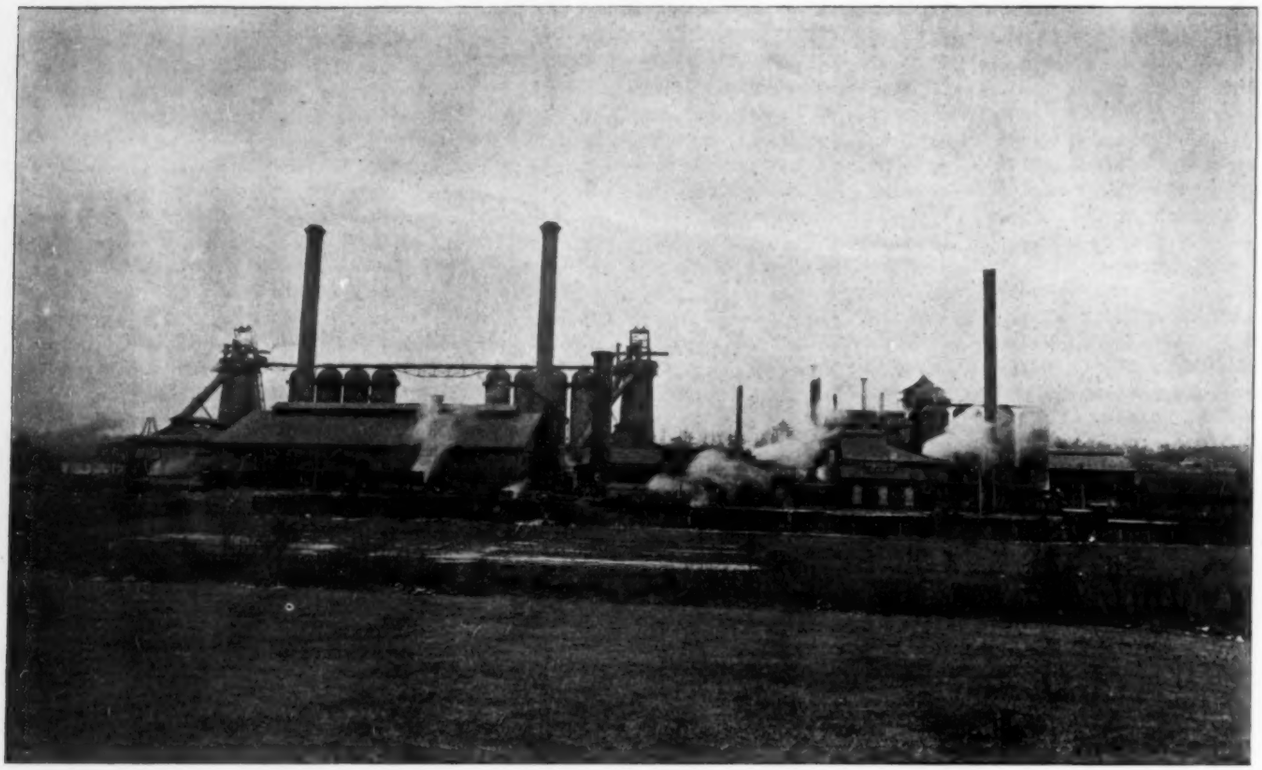
A chimney to give a draft of 0.75 inch must be about 125 feet high, and one to give a draft of 1.5 inches would probably have to be at least 250 feet high. The cost of the higher chimney would be so very much greater than that of the lower that few engineers would recommend it solely because of the lower draft which would be maintained with it. In the case of a mechanical draft apparatus, however, the apparatus to supply the air for the combustion of a given quantity of coal per hour under a maximum draft of 0.75 of an inch would be larger and cost more than the apparatus to supply the air for the combustion of the same quantity of coal under a maximum draft of 1.5 inches. The diameter of the fan wheel for the higher draft would be only about 0.83 of the diameter of the fan wheel for the lower draft, and the dimensions of the engine, assuming it to be direct-connected to the fan, might also be smaller for the higher draft. The work done in running the fan for the higher draft would be twice as great as that for the lower, and hence the running expenses would be almost twice as great, but even then the running expenses would be small. Thus to supply air for the combustion of 5,000 pounds of coal per hour with an economizer under a maximum draft of 0.75 of an inch of water, an induced mechanical draft apparatus would require a fan with a 7-foot wheel; while to supply air for the combustion of the same quantity of coal under a maximum draft of 1.5 inches a fan with a wheel 6 feet in diameter would be more than ample and a 5½-foot wheel would be almost large enough. The 7-foot fan would have to be run at a speed of 195 to 200 revolutions per minute and would require a direct-connected engine having a cylinder 6 inches in diameter with an 8-inch stroke; while the 6-foot fan would have to be run at a speed of about 325 revolutions per minute, and an engine having a cylinder 6 inches in diameter and an 8-inch stroke would be more than ample for it, because of the greater number of revolutions made per minute. The dimensions of the engine are based upon the supposition that the boiler pressure would be at least 100 pounds. This example illustrates the curious anomaly in regard to the difference between a chimney and a mechanical draft plant. In the case of the chimney the consideration of the first cost makes the engineer keep the chimney as low as possible and get along with as low a draft as possible; while in the case of a mechanical draft apparatus the consideration of first cost makes the engineer keep the draft as high as possible. The running expense is what makes the engineer keep the draft given by a mechanical draft apparatus low, but the running expense is usually more than offset by such advantages as the ability to burn cheaper fuel and to maintain a hotter fire in the furnace, thus securing that more perfect combustion for poor fuels which always attends a high draft.

EMINENT MEN OF THE IRON WORLD

II. JOS. WHARTON

By B. S. Stephenson.

It is a common practice nowadays to speak of one who has spent a lifetime in a certain line of activity as a "pioneer" in that industry, though in reality he may have merely followed in the footsteps of those who blazed the trail and cleared the way: the true pioneers. To the latter class Joseph Wharton belongs. His claim to the distinction is not based on his attainments in a single field of effort, for to him must be ascribed the establishing of at least two great industries in America besides his doings in iron and steel, gold, silver, copper, lead and tin.



The Wharton Furnaces, Wharton, N. J.

It was under his direction and in furnaces constructed in accordance with the results of his experiments that metallic zinc, or spelter, was first produced on a commercial basis in the United States. After demonstrating that it could be so manufactured, he turned his attention to nickel, and here his success in the production of zinc was duplicated and surpassed, for he won the signal honor of being the first in the world to produce pure nickel in malleable condition. He played a principal part in establishing here the manufacture of armor plates and large steel gun forgings, etc.: namely, at the works of the Bethlehem Steel Co., which, under the superintendence of John Fritz, was already famous for the excellence of its products. Aside from these, he has won distinction in several other industries. It is worthy of note that he is now the largest individual producer of pig iron in America; that he has brought the concentrating of iron ores to a high state of efficiency and that he is the dominating factor in the steam-vessel fisheries of the Atlantic coast. He has given freely of his time and means in aid of better education, being always a staunch supporter of the practical in college training. And finally, busy as he is with a multitude of business cares, he finds time now and then for a clever bit of literary work, the enjoyment of which is reserved for a little circle of his friends.

Early Days.

On March 3 last, Joseph Wharton was eighty-one years of age. Philadelphia, where he now resides, was the place of his birth. Each of his parents inherited what was considered a competent fortune in the early days of the country, but, as there were ten children in the family, the share of each of the boys merely provided a modest foundation upon which to embark in business, and did not suffice to spoil them.

As a youth Mr. Wharton was not of a notably robust constitution, and his parents deemed it wise to give up the course at Harvard planned for him to substitute a term of life in the country. Accordingly, at the age of sixteen he was sent to work on a farm about 50 miles west from Philadelphia, where three seasons of participation in the rough, rigorous duties of the country lad before the time of farming by machinery gave him a foundation of rugged health and hard common sense which, fostered by careful living, have stood him in good stead through his long and active career.

That he was thus deprived of a college training meant for him less than might be supposed, because he early formed the habit of study and of systematic reading, and in that manner gave himself an education that was at once broad and useful. His sympathies have always been generously extended to the idea of practical courses in the university curriculum. He has been continuously president or chairman of the board of managers of Swarthmore College since the year 1883, and has contributed largely to that institution, which is a creation of the Society of Friends or Quakers, of which he is a member. By his gift of $100,000 to the University of Pennsylvania in the year 1881, he founded "The Wharton School of Finance and Economy," to which endowment he has added $400,000 besides certain real estate. That school under its new name, "The Wharton School of Finance and Commerce," has become one of the most important departments of the university, and has been imitated in greater or less degree by many other universities and colleges.

Service as Bookkeeper.

At the age of nineteen, Mr. Wharton took service as a sort of apprentice with the Philadelphia dry-goods house of Waln & Leaming. At the end of a year he was head bookkeeper, with some 800 accounts in his charge. In winning this rapid advance, he displayed the quick and thorough grasp of any subject which interested him, or appealed to him as duty, which was to mark all his later activities. Having thus mastered the intricacies of bookkeeping, he desired the head of the firm to transfer him to the sales department that he might learn the methods of salesmanship.

"You're making a great mistake, Joseph," said Mr. Waln, "A great mistake. When you get into business for yourself you'll find plenty of men who can do your selling for you, but you'll never succeed unless you can manage your own counting house. That's the place for you to stay." So there he stayed with no compensation but his practice until he reached the age of 21, when he promptly embraced an opportunity which presented itself for embarking in business on his own account. His brother Rodman had been engaged for some time in manufacturing white-lead, having erected a large factory for that purpose. More capital was, however, desirable, and Joseph accepted his brother's invitation to invest his patrimony in the enterprise, in which the next few years were spent until an opportunity offered to sell the entire establishment to a rival firm.

A Hazardous Venture.

Small and apparently unimportant events sometimes interpose to shape the career of a man. In this case it was a vacation trip which took the form of a horseback tour to and beyond the Lehigh Valley region and passing through Bethlehem, Pa. Near that borough the party stopped at Friedensville, where a mine of zinc ore was worked, and visited afterwards at South Bethlehem a factory producing from the ores of that neighboring mine zinc oxide, which was rapidly winning a place as a substitute for white-lead. An inspection of the mines and plant convinced the party of the opportunities open to that new industry, so that on their return to Philadelphia several of them purchased stock in the company which ostensibly owned the mine and factory.

Later developments, however, proved the venture to be hazardous, for it was found that the company did not have a clear title to the mine and that its factory was leased to a manufacturing concern which took the ores and produced the oxide upon terms onerous to the company. Furthermore its charter was of doubtful validity. Joseph Wharton was invited to go to South Bethlehem and take charge of the company's affairs, which had gradually been brought into much better condition, when the money panic of 1857 overwhelmed the country and menaced the Zinc company with speedy ruin. In this crisis he leased from the company its entire property for the period of seven months during that hard winter; he to operate the mine and factory on his own account, giving to the company as rental two-fifths of the zinc oxide produced. This campaign saved the company and yielded handsome profit to both parties. After the lease terminated, Mr. Wharton operated all the company's properties as salaried manager, but also turned his attention to the manufacture of crude metallic zinc, or spelter which theretofore had never been produced in this country in such quantities or at such cost as to give promise of a practicable industry. The concern, then called the Lehigh Zinc Co., had as early as 1856 caused to be erected at Friedensville a spelter furnace of the Silesian type, but it attained no success and produced no spelter. Samuel Wetherill, who had introduced the zinc oxide manufacture at South Bethlehem, endeavored with better result to solve the problem of making metallic zinc, for in about two years of effort he did produce some 50 tons of excellent spelter, though at such cost that the project was abandoned. In 1859, Mr. Wharton, as manager of the Lehigh Zinc Co., undertook the erection of an experimental furnace. A few expert workmen were brought by him from Belgium, this being before the day of the contract labor law, when foreign operatives could be imported without difficulty. Refractory materials for the furnace and retorts, etc., came from the fire-clay deposits of Perth Amboy, N. J., anthracite from the Pennsylvania collieries and zinc ore from the Friedensville mines of the company. Mr. Wharton reported to the Zinc company that the entire cost of the experiment, including importation of workmen, construction of furnace, tools and all collateral expenses, was $3,795.89. The quantity of spelter produced in the short experimental period was 34,063 pounds. This successful enterprise was the beginning of the manufacture in this country of metallic zinc, the production of which in the United States in 1905 was 203,849 net tons of 2,000 pounds.

Manufacturing Spelter.

Once the feasibility of spelter production had been determined, the Lehigh company, of which Mr. Wharton was one of the chief stockholders, at once prepared for its manufacture on an extensive scale. He constructed for that company but at his own risk a complete plant of 16 Belgian furnaces, in four blocks or groups; also a complete manufactory of fire brick, retorts, etc., and roasting furnace. This establishment he leased from the company for a term of two years, which was extended three months by reason of a disastrous Lehigh river freshet; he operated the works on his own account, paying the company a stipulated price for its ores, as well as rent for the works. Financial difficulties incident to the outbreak of the civil war rendered the sale of the product on safe terms at times difficult, but the plant was run with handsome profit until the expiration of the lease.

The Lehigh company was not one of the sort that could stand prosperity. Its stockholders saw Mr. Wharton paying an annual rental on its plant, operating it on ores for which he paid the company suitable profit and still winning large returns. They were carried away by the idea of combining all these avenues of profit, and without considering the possibility that good management might have had something to do with its success, declined to lease the works or to employ him on salary. They took the works into their own hands, doubled the size of them and soon encountered troubles. Mr. Wharton had been able to handle the Belgian workmen nicely because of his intimate knowledge of the men and his ability to converse with them in French. The change in management brought on a strike and higher wages; the doubled works cost more than was expected and produced less spelter than the original 16 furnaces; instead of realizing enormous profits as it had expected, the company shortly went into bankruptcy.

The Nickel Business.

Mr. Wharton had thus in 1863 retired from the manufacture of spelter. Before he had engaged in other activities,

his attention was directed to the difficulties encountered by the United States government in procuring sufficient refined nickel for the coinage of the nickel-alloy cents then in use. In 1864 he purchased the abandoned Gap nickel mine in Lancaster county, Pa., securing also an abandoned nickel refining plant at Camden, N. J., thus undertaking to resuscitate an industry which had perished. Though for many years he was the only producer of nickel in this country, the market was always unreliable and the price unsteady, so that the operation of these works was for a long time an uphill task with only indifferent returns.

OBVERSE.

REVERSE.

THE WHARTON MALLEABLE NICKEL MEDAL.

After the close of the Franco-Prussian war, the German empire decided to substitute for the miscellaneous, ill-designed coins of the various German states one system of coinage for the entire empire, the minor coins to be made of the same alloy of nickel and copper which was used by Belgium, the United States and France; namely, one-fourth nickel and three-fourths copper. After the needful legislation was completed, Germany found to its surprise that nickel was extremely scarce and its price increased threefold. Mr. Wharton went to Germany, had a conference with the master of the mint and supplied for several years at high prices a large proportion of the nickel used in the German coins.

Highly Valued Medals.

A little cabinet in Mr. Wharton's office at Philadelphia contains a handsome medal struck to commorate his being the first person in the world to produce pure malleable nickel. This was accomplished in 1865, the process was afterwards much improved by Dr. Theodor Fleitmann, and the new product has gradually found its way into the manufacture of many useful articles. In the cabinet with this medal, and another one commemorating the founding of the Wharton School of Finance and Commerce at the University of Pennsylvania, is a ship's compass, the needle of which, made by Mr. Wharton of pure malleable nickel, has retained its magnetism with little diminution since 1876.

For a quarter of a century the Gap nickel mine was the only one in operation on the American continent. Its ore deposits, however, have been virtually exhausted, and the discovery of richer deposits first in Noumea and afterwards in Canada, shifted the nickel mining industry to the latter country, so that the International Nickel Co. now produces from its Canadian mines about two-thirds of the world's output of nickel. Mr. Wharton's Gap mine and his refining works in Camden, N. J., were taken over by that company, of whose board of directors he is a member.

Mr. Swank's Tribute.

In a recent issue of the *Bulletin of the American Iron and Steel Association*, Mr. Swank writes as follows: "Mr. Wharton's enterprise gave to the government a cheap supply of nickel that was essential to its nickel coinage, and to the whole country an abundant supply of the metal then much needed for making German silver as well as for coinage, and now imperatively needed in much larger quantities for making the nickel steel so largely used for armor plates, gun forgings, etc. The world does not know how much it owes to its enterprising and courageous manufacturers."

While living at Bethlehem, Pa., Mr. Wharton became interested in the manufacture of iron, later destined to overshadow his other activities. Early in the 60's, the community at Bethlehem reached the conclusion that an iron furnace was necessary to its industrial welfare, and called upon John Fritz to build it. The Bethlehem Iron Co. was organized, Mr. Wharton not being an original stockholder, but, becoming interested in it, he purchased stock from time to time until his holdings much exceeded those of any other person. The project encountered difficulties, but gradually prospered; finishing mills were added, first for the manufacture of iron rails and other products and later, on the introduction of the Bessemer process, to turn out finished steel rails and other products.

Secretary Whitney's Plan.

The years following the civil war were full of progress. The country was advancing rapidly and was aiming at greater things. The lessons of that conflict indicated unmistakably that the fighting craft of the future must be the steel-clad ship. Plants for the manufacture of armor plate were springing up abroad and the authorities at Washington came to the conclusion that the safety of America demanded that it be so equipped. The question was threshed over at length and finally William C. Whitney, then secretary of the navy, sent for Mr. Wharton. "We want an armor plant," he explained. "We have procured from congress an appropriation for about four and one-half million dollars for the purchase of steel armor plates and gun forgings, and we want a plant in this country for their manufacture. We have looked all over the country to choose the best method of establishing these works and have decided that the Bethlehem Steel Co. must undertake the task; you to manage and finance the enterprise and John Fritz to superintend it as engineer."

Mr. Wharton was given to understand that the contract for furnishing the armor plate, etc., for which appropriation had been made would go to his company provided it would submit a bid not in excess of the price at which the products could be procured abroad. As a preliminary to the task, he made a trip abroad, visiting first the steel forging plant of Sir Joseph Whitworth Co., at Manchester, England. Included in the organization of a rival English plant, were certain British officials influential in naval affairs, who saw to it that their works were kept plentifully supplied with orders. The Whitworths, incensed at the constant rejection of their bids, readily agreed, for a round consideration, to build for the Bethlehem company the needful forging machinery and to encourage the use of their processes of manufacture in America. Next an even half million dollars was paid for the patent rights, processes and assistance of the important armor-plate plant of Schneider et Cie at Cruesot, France, and Mr. Wharton returned with preliminary contracts, these details having been cleared up. Bids were prepared in accordance with the suggestions of Mr. Whitney, contracts were executed with the United States government, and at Bethlehem the task of constructing the great works was begun.

A Gigantic Hammer.

From the first the Bethlehem officials inclined to believe that the most practical system of steel forging for large objects was the hydraulic pressing and kneading of the plate, coupled with other improved methods developed by Sir Joseph Whitworth, but Secretary Whitney had insisted that the aid of the Creusot Works should be secured, and this required that arrangements must be made for hammer-forging the steel ingots. For this reason the giant hammer, with a drop of 125 tons, was constructed. In the bed of the Lehigh river near the Bethlehem plant heavy oak piling, steel shod and reinforced at the top, were driven as thickly as the great sticks could be forced into the close beds of boulders and gravel. These were sawed off to a level top and on this foundation was placed a platform of large squared oak timbers with another similar platform laid crosswise on it, the latter covered by a closely laid floor of heavy steel rails. This in turn was surmounted by huge blocks of cast iron, forming a pyramid upon whose crest the anvil was placed. The lifting mechanism of the hammer was separate, supported by wide straddling legs resting on their own foundations. It was thought that this arrangement would give stability to the structure, but it was not long in use before the mass began to settle beneath the terrific impact of the hammer. This necessitated the taking apart of the foundations of the anvil down to the oak platform. On this a thick cushion of white oak chips was installed, the structure was replaced and the blows of the hammer caused no further shifting. This great hammer was long ago displaced, however, by the Whitworth system of hydraulic squeezing or forging and was torn down. This was the largest drop hammer ever constructed, and engineers say there is no reason for supposing it will ever lose that distinction.

Difficulties and Success.

How the Bethlehem Iron Co., after unforseen delays and the expenditure of vastly more money than was at first anticipated, finally made a success of the manufacture of armor plate, how it stood the exacting governmental tests and how later on it was forced to divide the field with rival concerns—all this is familiar history. Mr. Wharton was never president of the company, but, as director and the largest stockholder, he largely guided its policy for a number of years. Then in the year 1901 a proposal for the purchase of the works came from a syndicate of men interested in steel-making, and a combination of circumstances induced the company to consider the proposition. Tedious, dilatory negotiations followed, until finally Mr. Wharton, who had been empowered to act for the company in this connection, and Mr. Linderman, whom he had requested to join him, declared the deal off, being thoroughly disgusted with an attempt of bankers representing the prospective purchasers to interject new conditions after all the terms of sale had been agreed upon. A few days later, Charles M. Schwab learned that the Bethlehem company might be purchased. A meeting was arranged in New York, with Mr. Schwab; when it was concluded, the sale had been made.

"Perhaps fifteen minutes were required to close the deal," said Mr. Wharton recently, contrasting this prompt action with the months of futile dickering which had preceded it.

As chief engineer and general manager of the Bethlehem works, John Fritz deservedly won a world-wide reputation. But not less important, though much less obvious, was the part played by Joseph Wharton in shaping the organization and financial destines of the enterprise. The two men, so long closely and amicably associated, supplemented each other's work, though they did not always agree. For instance, Mr. Fritz was often besought by Mr. Wharton to visit him at his summer home near Jamestown, R. I., but the prudent engineer persistently refused, very frankly explaining his fear that he might be enticed into a cat-boat cruise in the broad open waters of Narragansett bay. "Why, I'd much rather ride behind a runaway horse than get into your cat-boat," he once declared.

Owner of Blast Furnaces.

Four modern blast furnaces with a normal daily output of 1,000 tons give Mr. Wharton the distinction of being America's largest individual producer of iron. He first began making iron on his own account about a third of a century ago in a small, poorly-equipped furnace at Hackettstown, N. J., which was not in keeping with his ambitions. After operating it for a time, he traded it for an idle railroad near Dover, N. J., thus coming into possession of a part of the railway system, which, extended and modernized, now serves his furnaces with ores from his New Jersey mines. Some time later, he bought a small furnace at Port Oram, N. J., (the name of this place eventually being changed to Wharton) which he modified and rebuilt until it became a complete, well-appointed plant. Its working encouraged him to erect in 1900-01 a great, modern furnace plant of the million-dollar type, combining in it all that was best of blast-furnace design and equipment. Two years later, another of similar design was added to the group at Wharton, which now has a normal annual capacity of about 300,000 tons. Mr. Wharton also acquired the Andover furnace, at Phillipsburg, N. J., by purchasing the entire capital stock of the Andover Iron Co. The normal annual output of his quartet of furnaces is now about 360,000 tons.

Most of the ore smelted in these stacks comes from magnetite mines owned by Mr. Wharton in New Jersey, and from his hematite mine in New York; Lake Superior ore, nodules, etc., being added as occasion requires. His belief in the ores of New Jersey has led him to acquire from time to time extensive deposits in the mountains near his furnaces. Today his ore lands aggregate over 5,000 acres and include the Wharton, Andover, Hurd, Orchard, Hibernia, Teabo, Mount Pleasant, Allen, Byram, Scrub Oaks and Baker mines. Though he has bought freely of outside ores when prices and quality suited, thereby holding part of his own deposits in reserve, he is always drawing heavily upon his own mines to supply the insatiable demands of his four great stacks. He also became the owner, by purchase some years ago, of the famous Rossie mine above alluded to; a large producer of hematite ore in St. Lawrence county, N. Y.

OBVERSE.

REVERSE.

THE WHARTON SCHOOL OF FINANCE AND ECONOMY MEDAL.

Future of Iron Business.

"While it is true," said Mr. Wharton recently to the writer, "that the large steel-making concerns aim to shape their

affairs so as to produce all the pig iron they consume, thereby removing what has been an extensive and desirable market for the independent producer, it appears certain that the early future will witness a tremendous increase in the demand for iron in this country. We are today producing at the rate of twenty-five million tons a year; only a little while ago, our annual output was but half that amount. It is bound to increase at a rapid rate and the independent furnacemen will be called upon to do their part at a fair profit."

The furnaces owned by this Philadelphia iron-maker are well provided with fuel for a long term of activity. In Fayette county, Pa., he owns a moderate acreage of coking coal with a battery of eighty-six ovens. In Indiana county, he owns 7,500 acres of coal and is operating about 300 bee-hive ovens, a finely-equipped plant with the best machinery of every sort installed only a few years ago at great expense.

Concentrating Plants.

Mr. Wharton owns also 24,600 acres of choice coal in West Virginia. As for ores, not only are his magnetite mines equipped with the best new machinery of all sorts, but he has made ample preparations to win good iron ore from the veins whose ores are too low in iron for direct treatment in the blast furnaces. In connection with the Hibernia and Andover mines, he has three magnetic concentrating plants now in operation and a fourth is being constructed. That they have solved the perplexing problem is evident from the fact that they are now bringing up the average iron content from less than 45 to near 60 per cent. In his machines the ore is being crushed until the largest lumps are about the size of a walnut and the smallest that of a wheat grain. This overcomes the difficulty at which Thomas A. Edison turned back when he sought to make possible the utilization of low grade Jersey ores, for he attempted to make commercially profitable the working of ores originally too low in iron, also he ground the mineral to powder before subjecting it to magnetic treatment. The result was that a good part of the fine ore dust blew out of the furnace where it was used, and the problem of briquetting the ore, designed to overcome this difficulty, was never satisfactorily worked out. The concentrating process, as carried out by Mr. Wharton's patented machines, is of further benefit in reducing the phosphorus content of the ore, this troublesome element appearing much more freely in the low grade refuse than in the concentrated workable ore. All the crushed rock separated by these machines from the ore finds ready sale for concrete work, road making, etc. Mr. Wharton employs altogether more than 2,000 men, many of whom are housed in more than 500 dwelling houses belonging to him.

Personal Characteristics.

At the Christmas season in 1902 some of Mr. Wharton's friends were the recipients of a handsome booklet, privately printed, containing a poem of some length, dealing with conditions in Mexico as he found them on a visit there years ago, and venturing in the closing lines a prediction which is already on the way to fulfillment:

"Prophetic eyes but faintly have begun
To see the lofty climax of thy powers,
When the full noontide of thy day is won,
And gathering night on weary Europe lowers."

It is a splendid bit of description, touching on the picturesque history of old Mexico and depicting it today as "a land majestic, apt for all delight." Another of his poems, "Poseidon in America," depicts the march of sea powers ending with a portrayal of the mastery of the sea by modern steel battleships, in contrast with the reliance of the ancient Greeks upon their god Poseidon for naval success.

His addresses delivered each year before the graduating class of Swarthmore College reveal the wide learning of the man and his ability to present in clear, forcible style the soundest and most practical of advice.

There is nothing in the appearance of Mr. Wharton today to betray the fact that he is the mild ruler of many men, or that he has passed the eighty-first milestone. His hand is as steady, his voice as strong and his step as vigorous as though he were of a later generation than that which saw the beginning of manufacturing in America and took its part in the early industrial struggles of a resourceful people. His spare, well-built figure bears few evidences of his more than 60 years of business toils. He has thriven on hard work without stimulants, and even now is diligent and cheerful, regularly at his office, except when making an occasional trip to New York or other points, even to the wilds of Nevada or Idaho, where duty or interest calls him. He finds much wholesome enjoyment in such part of the three sultry months as his duties permit him to spend with his family at his beautiful summer home on Conanicut Island in Narragansett bay, where lawn tennis and deep sea swimming amuse him. His Philadelphia home, surrounded by a wooded park of nearly seventy acres, is a veritable *"rus in urbe,"* a country place in the city. He has another home in New Jersey, where he owns about 200 square miles of land, but, at 81 seldom finds him to visit it. He has received the honorary degrees of Sc. D. from Pennsylvania University and LL. D. from Swarthmore College. He is president of the American Iron and Steel Association and is a member of The Iron and Steel Institute; is almost the oldest member of The American Philosophical Society. He was for many years a foremost champion, though in an unpretending way, of the cause of protection to home industry.

VARIABILITY OF STEEL.

Meeting of the Birmingham Metallurgical Society.

At a meeting of the Birmingham Metallurgical Society, held at the Technical School, Birmingham, England, Saturday, March 9, Alexander Jude, Birmingham, read a paper on the "Variability of Steel." The paper treated of the efforts to produce one specified grade of steel in the form of one class of forgings for crank shafts of moderate size from 35 to 38 tons. The observations extended over 100 forgings taken in order as received from the forge at Sheffield, at random, and without selection. By observations on this large number, the tests comprising tensile, impact and microscopic, the lecturer traced the relation between the microstructure and the mechanical tests. It was shown that makers apparently have comparatively great difficulty in getting within the specified limits, the actual range extending from 29 to 42 tons. This may be due partly to incorrect grade, and partly due to the variable results of annealing. Micro-photographs of all these forgings were shown grouped in relation to a standard appearance of the tension fracture and in relation to the impact test. Each group was divided into subdivisions of two-ton ranges extending from 29 to 42 tons. It was shown that the microstructure varies between great limits, and that although without an analysis of each sample the microstructure by itself does not appear to be quite a conclusive guide as to the quality of the steel, yet there is on the whole a decided tendency to follow the two features mentioned.

Discussion was particularly invited concerning the steel makers' difficulty in "hitting the mark," and as to the real possibilities in variation of results of annealing when the treatment is apparently invariable. The general opinion of the meeting was that the steel makers do not know much about the matter, and the treatment of steel is in a much more elementary condition than is usually taken for granted.

The Ohio Shippers' Association will hold its annual meeting at the Southern hotel, Columbus O., April 9. There are about 5,000 members in the association.

THE UTILIZATION OF LOW GRADE FUEL IN GAS PRODUCERS--I

By F. E. Junge.[1]

"I am bold enough to go so far as to say that raw coal should not be used for any purpose whatsoever, and that the first step toward the judicious and economic production of heat is the gas retort or gas producer, in which coal is converted either entirely into gas, or into gas and coke, as is the case at our ordinary gas works." When the late Sir William Siemens spoke these prophetic words in 1881 they were received with incredulity and opposition by engineers more conservatively disposed by far than are the majority of those who, today, constitute the imposing body of our profession. We have learned in the meantime that of all arts and sciences, that of progressive engineering is characterized, beside by vastness of scope, magnitude and utility of purpose, perceptibly by the spontaneousness of its growth or evolution, and that the prompt realization of stupendous tasks such as were deprecated as impossible and fantastic but yesterday, is an occurrence frequently met with and of no extraordinary mark today.

Of all problems which confront us in the concentration of modern industries it is the conservation of natural resources and especially the preservation of our irreplacable fuel supply which we must deem by far the most important. For just as the rising curve of iron production is indicative of the growing industrial prosperity of a nation, so is the output and consumption of coal inseparably allied in magnitude to the course of the former. The preservation of permanence of our fuel resources by economic methods of utilization, both of the ordinary grades of coal as bituminous and anthracite, and especially of the inferior classes such as lignite, peat, mine culm, etc., which were formerly wasted, is essential both for the maintenance of stability of modern industry and for the life and prosperity of future generations. It also is an instrument and measure of political prudence or precaution for every progressive nation, even when the economics of a rich country like America are concerned, not so much on account of an impending depletion of its coal fields, but on account of the extreme value they possess for future industrial activities. It may be objected that the sources of fuel supply have not yet been accurately measured up the world over, and that the centers of production may in times to come be found in countries that are now quite undistinguished in industrial annals, and which may, perhaps, pass beyond our control entirely. Yet every objection is subordinate to the utilitarian idea that America, owing to its abundant and comparatively virgin resources, will sooner or later become an important seller of coal to the older European countries which are becoming rapidly impoverished, since with the growing shrinkage, their remaining store cannot keep pace with the rising demand for very long.

[1]Consulting Engineer, New York.

Economic Features of Fuel Utilization.

That the economic utilization of our irreplacable fuel resources is of the greatest importance also for present industrial pursuits can best be realized when recalling the fact that the world's total annual coal production and consumption has increased from the time of the invention of the steam engine, that is, within 125 years, to approximately 50 times its original value, while until a very short while ago not over 5 per cent of its total energy was usefully employed for the generation of heat, light, and power in the various industries. It is only within the last 10 years that the conditions of power production were brought to a higher level of economic excellence. Taking a concrete case: The total amount of coal consumed in United States manufactures for purposes of power generation runs up to almost 100,000,000 tons per year, representing about 25 per cent of the total annual coal production. Figuring at an average price of $2.00 per ton, it is obvious that the universal adoption of a method of generation which will render an equivalent power service at one-half the consumption will represent an annual saving, in treasure, of some $100,000,000, disregarding entirely what the saving in fuel means to future generations.

Recent comparative researches made among others by the U. S. Geological Survey, which were undertaken with a view of demonstrating to the public the great practical possibilities of securing higher efficiencies in the use of fuels, have confirmed the claims of gas power advocates, viz., that the average bituminous coals, as well as lignitic and peat fuels, will yield in gas producers from 2.4 to 3 times the amount of power they will give when burned under steam boilers of equivalent capacity. And what is even more important, that certain low grades of coal which can hardly be used for steam raising can be successfully utilized by direct gasification in producers.

Economic Effects.

As a direct result of these performances the following economic effects are established: 1.—The kinetic capacity of our fuel resources has been more than doubled. 2.—Materials and property which were deemed utterly worthless up to this date have assumed immediate values, to the benefit of the owners. 3.—Industrial expansion has been made possible over wide territories which hitherto precluded the invasion of capital and commerce owing to scarcity or lack of suitable fuels.

The object of this study is to describe and illustrate some of the more remarkable means and methods which have been devised in Germany, where the problem of economic fuel conservation is one most patent to the engineer, for converting such fuels as lignite, peat, culm, etc., into gas in producers, whence it may be transformed into heat, light, or power, as the circumstances demand.

The gasification of anthracite and coke in suction producers, and the utilization of the resulting gas in gas engines is almost a matter of the past so far as the regular grades, nut, buckwheat, etc., are concerned. Yet it has been demonstrated that even at such high prices as $5.00 per ton competition with modern steam plants, (Wolff semi-portable locomobiles), is possible in the smaller sizes. But the saving effected when operating on a large scale and in competition with up-to-date steam plants burning low grade bituminous coal is not large enough to induce power users to abandon a traditional and wasteful, but reliable, mode of power generation in favor of the new claimant. So it was natural that gas power engineers would try to utilize inferior grades of coal, such as are undesirable for steam raising, either on account of excessive moisture contents, or owing to drawbacks in size and composition, (dust coal, coke breeze, lignite, peat, etc.). To illustrate the commercial value and importance of such utilization for certain localities let us take a concrete case from German practice. There the price of average good gas coke is, in certain districts, about three times higher than that of lignite briquettes, while its heating value is only one and half times higher. So the cost per unit power in producer gas engines is from 40 to 50 per cent lower when using lignite briquettes than when burning coke.

Other conditions being equal, heat density and transportation factor will fix a definite economic limit beyond which a certain coal from a certain mine is no longer applicable. In other words, the higher the heat density of a coal and the greater the transportation facilities, the larger will be the radius of its commercial distribution sphere, with the pit as the center.

High Class Lean Fuel vs. Low Grade Steam Coal.

In England much discussion is still wasted on the question whether or not these high class lean fuels can be or should be used in competition with the lower grades of steam coal. The results of a recent test made with a suction gas producer at Derby reveal the following conditions: With Scotch anthracite of good quality the consumption is 1.1 pounds at full load and 1.6 pounds at half load, per brake horsepower per hour. The average is 1.35 pounds, including standby losses. With coke the consumption is a little higher. The average consumption of cooling and evaporation water varied from 1 to ¾ gallons per brake horsepower. The price of equipment remains between $46 and $56 per developed brake horsepower, of which $20 was the price of the producer plant proper per unit. With anthracite costing $5.75, the fuel cost per brake horsepower runs up to almost 0.5 per cent.

In Germany, as above noted, it has been realized that the question of gas versus steam is very largely dependent on the employment, in producers, of cheaper grades of coal than were hitherto used. Of the non-bituminous classes which yield a gas free from tar, only the smaller screenings, buckwheat, pea, dust-anthracite and coke, have a reasonable chance for competition. Under certain local conditions they may even be superior to bituminous coal, lignite, and peat fuels.

To give an illustration: In a certain city gas power was to be adopted, and there were three different classes of fuel available: Anthracite nut at $5.00 per ton, anthracite dust at $1.70 per ton, and lignite briquettes at $2.00 per ton, having the following heating values: 7,500, 7,000 and 4,500 calories respectively, or 13,500, 12,600 and 8,100 B. T. U. per pound. The fuel consumption including all losses worked out at 0.25, 0.089, 0.18 cents per brake horsepower-hour for the three classes. So in this particular case dust anthracite was superior to all. It had the special advantage over lignite that the gas as produced was absolutely free from tar. Taking into consideration the factor of transportation it was found that the cost of fuel for operation with these three classes is equal when the prospective plant is located at the following respective distances from the mine: Anthracite nut 0, anthracite and coke dust 404, and lignite briquettes 73 miles. It is seen that dust-coke and anthracite owing to their low price and comparatively high heat value have the largest commercial distribution radius, in this case.

These figures are presented with no view of implying standards, but they are intended to show on how many variable factors the definition of the term "low grade fuel" is dependent and also how the less marketable values of a high grade coal may sometimes offer characteristics which justify their employment in competition with the inferior bituminous classes.

Before entering into the discussion of the processes and apparatus employed for the gasification of these fuels it will be well to get clear about their distribution and general characteristics. Also to study the data pertaining to the production and briquetting of lignite and peat.[2]

Lignite.

Lignite is, besides peat, the most important fuel in Germany. Compared to a production of 10 or 21 million tons of hard coal, 48,000,000 tons of lignite (brown coal) were produced in 1905, and in addition 5,000,000 tons were imported from Bohemia. Of this total about 10,000,000 tons were briquetted, since with the high contents of moisture (some sorts contain up to 60 per cent of water) the utilization of the raw coals would not be commercially profitable beyond the locality of their production, on account of the excessive transportation charges. The raw lignite is mined in big lumps of loose composition, which oftentimes show the original wood structure well preserved. Its heating value varies from 3,000 to 6,800 B. T. U. per pound. The process of briquetting the raw material consists of grinding it to a fine powder and heating the same in a double walled cylinder by means of steam until its content of moisture is reduced to 15 or 17 per cent. While being in this state of superheat, it is compressed at a pressure of from 21,000 to 29,000 pounds per square inch into the desired form and mostly without applying any binding material, since the tarry constituents contained in the fuel give sufficient cohesion. In the Rhine districts about 2.5 tons of sifted raw coal give one ton of briquette. For evaporating the surplus 2,900 pounds of water 1.3 times the weight of exhaust steam, namely, 3,800 pounds, is required. This steam is generated from the waste coal which remains available from sifting the raw fuel, and from 1,700 to 2,200 pounds of this combustible material is required, since one pound of coal will not give more than from 1.7 to 2 pounds of steam, even with the latest constructions. This low output is due to the fact that the dry combustibles of the coal must uselessly evaporate its own moisture content, a feature which finds expression in the difference of the heating values of the raw coal and of the briquettes made from it, the former containing only from 3,060 to 3,420 B. T. U., while the latter possess 8,100 B. T. U. per pound. Nevertheless, it is justifiable from the economic standpoint to employ wet lignite for steam raising in the briquetting process, since only the waste is used which cannot be utilized otherwise. When briquetting peat, this method would be uneconomical, since wet peat does not contain any waste, and therefore valuable combustible material which could be briquetted would have to be thrown away under the boilers.

The heating value of lignite briquettes ranges from 8,100 to 9,600 B. T. U. per pound. The heat density of briquettes in the size made in Germany is such that about 3,300 pounds can be stored in a space of 100 cubic feet. While the price of raw lignite varies from $1.75 per pound (Bohemian of 9,900 B. T. U. per pound delivered at Leipsig) to $4.30 (Bruex of 9,900 B. T. U. delivered at Munich), the price of lignite briquettes varies according to the location from $1.98 per ton delivered Cologne to $4.00 delivered at Hamburg. When gasified in the ordinary single bottom zone producer the gas generated from the raw lignite is high in hydrocarbons and produces an intense heat. Its composition is:

CO_2	6.4 per cent
C_2H_4	0.7 per cent
O	0.8 per cent
CO	22.0 per cent
H	9.6 per cent
CH_4	1.6 per cent
N	58.9 per cent

It contains a series of distillates, such as paraffine, tar oil, creosote, asphalt, which are driven off in the upper layers from the fresh fuel charged through the hopper. These products are kept suspended in the form of a vapor, and are mixed with the producer gas proper. While, when specially utilized, these constituents give out valuable by-products, they are worthless, undesirable and directly harmful when the gas is to be used for power purposes alone. Since, on the one hand they are mixed with water to such an extent that a transportation to chemical factories would not pay, on the other hand these by-products separate out from the gas when the latter is being cooled for engine use, and thereby obstruct pipes, pumps and valves of the engine, and necessitate expensive and cumbersome cleaning apparatus and additional manual labor. Even then the degree of purification attained is not sufficient to guarantee continuous and reliable operation. Therefore, the only successful method of eliminating the tar is to burn it, preferably in the producer proper. Hereby the operating difficulties are at once overcome, and the gas is enriched accordingly. Systems which do not embody provisions to that effect can no longer be regarded as up-to-date.

Peat.

Peat represents the first stage in the natural process of coal formation of which anthracite is the last. There are

[2]The corresponding data on American fuels are available in the regular reports published by the U. S. Geological Survey.

very large areas of peat land available all over the world. Germany alone has an area of 11,000 square miles. Ireland's area is one-tenth peat, and some of the Irish bogs are 50 feet deep. A square kilometer of bog 4 meters deep will yield 700,000 tons of dried peat, including what must be burned in the preparation. In any case, there is a vast store of peat if it can be obtained dry. The empirical formula of peat is: $6C_6H_{10}O_5$ before decomposition. As this vegetable matter carbonizes it produces: $7CO_2+3CH_4+14H_2O+C_{28}H_{20}O_2$, the latter being the peat. Approximately, of the combustible matter in peat 10-11 is carbon and 1-11 hydrogen, but part of the latter is neutralized by the oxygen. There is no sulphur, so that peat is capable of producing an ideal metallurgical fuel.

The manufacture of peat briquettes has not, so far, met with the same success as that of briquettes from lignite. The main reason lies in the fact that while raw lignite contains from 50 to 60 per cent of water, which has to be evaporated by its dry contents, peat contains from 80 to 90 per cent of water.

Therefore, to produce one ton of briquettable coal there must be evaporated from peat, containing 90 per cent of water, 19,800 pounds of moisture, and from lignite containing 60 per cent of water, 3,300 pounds of moisture.

Among the means of drying peat may be mentioned first the air drying process, which cannot be depended on, or, at least, is inefficient in unstable climates. Second, the mechanical process, which employs centrifugal and pressing machinery and filters, but requires a large capital outlay and consumes considerable power. With this method it is possible to reduce the water content down to 60 and 65 per cent. Third, the electrical process based on the phenomenon that the electric current drives the water without decomposition to the negative pole, while the peat cake settles on the positive electrode. To extract 35 cubic feet of water from the raw material, an expenditure of from 13 to 15 kilowatts is required. With direct current of 1,000 amperes it is possible to produce peat containing 40 per cent dry matter and 60 per cent water.

A new method of drying peat by electricity was invented by Graf Schwerin and has found extensive adoption in German practice. The process is based on the physical phenomenon known by the name of endosmose, which shows the characteristic feature that a liquid which is traversed by an electric current has the tendency to emerge through a porous partition wall. In the particular process employed by Schwerin peat is thrown on a wire screen and covered with a lead plate. When the electric current is sent through the peat the water which has remained there after compressing will drop out. A steam engine which uses this dried peat as fuel drives a generator, which, in turn, gives the current that is required for drying purposes. The steam engine only consumes one-fifth of the quantity of peat produced for the operation of the process.

A fourth method consists in the employment of closed ovens or retorts wherein peat is carbonized by the heat of the gases driven off, and the waste heat furnishes the means of drying off the material. This is called the Ziegler process, giving from three tons of air dried peat one ton of peat coal, or coke, which serves as a substitute for charcoal and costs $10 per ton. From a ton of peat there are obtained 760 pounds of coke, 88 of tar, 12 of alcohol, 8 of ammonia sulphate, 12 of acetate of lime, the lime and the sulphate being added components. This idea, of producing products more valuable than peat and of smaller weight per unit value appears sound. In practice, the cost of by-product recovery and the saleability of the by-products will determine the commercial economy of the process to a large extent.

It may be mentioned that in the process of dry peat production from the raw material gas engines cannot be used to advantage, as in this case not the thermal efficiency of the gas plant, but the complete commercial economy coefficient must be considered. The all-round economy of a steam plant for this kind of work is greater than that of a gas plant, as the steam engine with from 12 to 16 per cent thermal efficiency gives off the total amount of exhaust steam containing 75 per cent of the heat introduced, while the gas engine only gives out the sensible heat of the exhaust gases, that is, about 20 per cent for the purpose of drying, leaving aside the amount of steam which can be generated from the sensible heat of the producer from the overflowing gases and from the engine jacket water.

The best practice, if the local conditions favor the distribution of electric current to the neighboring districts, is naturally to produce gas from peat and employ it in gas-engine-driven dynamos for the generation of electric power.

With regard to the price of peat coal, it is claimed that the fuel may be produced at $1.90 per ton. The Ziegler process costs more, but this is in some localities equalized by the value of the costly by-products.

One man with a digger will dig five tons of raw peat, equal to half a ton of dry fuel, in an eight-hour day. A dredger 110 feet long would gather in the neighborhood of 300 tons of dry peat a day with, perhaps, three men as a crew, thus reducing labor charges to a very low point.

The economic attainments of peat in producer work will be discussed later.

The extraction of the tar is best performed by burning it in a second incandescent zone in the producer proper, whereby the gas is enriched in proportion to the heat contents of the tar. This method has given as excellent results, in producers of modern construction, as have been attained with lignite.

Briquetting for Producers.

A few words may be said on the important question of briquetting raw fuels for use in producers. It was mentioned before that peat should preferably be used in raw form whenever possible, since briquetting does not pay, if the briquettes are to be transported over wide distances. Their low heat density, that is, the thermal value per unit space, precludes their commercial distribution over wide territories, especially in a country like the United States.

In Germany the railways are owned by the government and are run with a view to aiding the development of industries rather than securing the maximum immediate profits from their operation. River and canal traffic are also more in vogue, and in cases where the tariff rates imposed by the government on the transportation of raw materials are too high, as in the iron industry, there several concerns will unite and build their own electric railway so as to get control of the transportation factor, similar to what obtains in the United States Steel Corporation. So the trouble that confronts the briquetting industry in Germany is not so much that of transportation, at least not so far as lignite is concerned, but is offered by the fact that lignite briquettes are being more and more used for domestic purposes, and that the larger sizes there employed can be manufactured with greater profit than can the smaller sizes which must be used in producer work in order to secure regularity of operation. On the other hand, the price which is paid for the smaller briquettes in industrial pursuits is usually lower than what can be obtained from the sale of larger briquettes for domestic uses. Therefore the inducement to manufacture producer briquettes is not very great and there is danger that the supply may not, in some not distant time in the future, keep up with the rising demand.

Summarizing, it may be said that the event of the gasification of coal in producers has brought about a marked tendency for specialization in methods of power generation. There is for every locality a certain fuel, and for every fuel a certain producer, and for every producer a certain application, and it is only by a judicious combination of the three factors that maximum industrial economy of operation can be secured.

EXPENSE: MANUFACTURING AND COMMERCIAL.[1]

By F. E. Webner.[2]

A sharp line should be drawn between the two classes of expense items for obvious reasons; items which are purely and simply matters pertaining to sale of product have no place whatsoever in the cost of production. The commercial expense has to do only with the selling of the machine and includes any items arising subsequently between the customer and the manufacturer, as for instance freight on the machine, allowances of any nature whatsoever after the machine has left the factory, quantity discount, cash discount, etc.

It oftens happens that items which are charged to cost of production have no real place there and as a consequence when concerns of a similar line of product attempt to compare costs of production they fail dismally for the reason that there is nothing like uniformity as to what constitutes cost of production. Some concerns charge into manufacturing expense the items of interest on investment, others do not; some concerns will charge supplies such as files, etc., directly to manufacturing expense without first having put them through the store room, even in cases where a large supply is purchased for future use. The following list of accounts is given as a general outline of what constitutes manufacturing expense that must be diffused over product.

Where departmental expense is used each item of manufacturing expense should be divided among the several departments on an equitable basis, each month or four week period, and a general apportionment cannot be consistently followed out for the reason that some items of expense are not applicable to all departments, therefore each class or nature of expense should be specifically treated.

Power costs should be spread on a basis of horse-power consumed, rent or interest on factory investment, repairs, etc., spread on a basis of space used, etc.

In the matter of the diffusion of manufacturing expense over product the man-hour basis is the most equitable and the plan that gets nearest to the true burden. The spreading of expense on the basis of a percentage of labor cost or material cost, or both together is absolutely arbitrary and is based on past history rather than present facts. The cost of labor bears no relationship to the loading of expense, inasmuch as the apprentice partakes as much of the expense element as does the high-priced machinist. Of two employes at the same kind of job, a slower man naturally should absorb more expense burden than the quicker man on the same amount of product which under a percentage basis is not done. A cheap casting which may need considerable machine work and many handlings will absorb more expense than a piece of high-priced material with little or no machine work necessary; it is not properly spread under a percentage basis.

The man-hour rate is obtained by dividing the total number of producing hours for a given period into the total manufacturing expense for the same period and thereby obtaining the constant or rate per hour; if each shop order is charged with an amount of expense equal to the number of production hours employed on it, multiplied by the constant per hour, then the manufacturing expense burden will be accurately spread.

Rent.

This is clearly a manufacturing cost and where concerns own their own plant the item of interest on investment in factory plant would take the place of rent.

Taxes and Insurance.

In cases of warehouses stored with finished product it seems advisable to charge the insurance thereon to commercial costs as such would not strictly be a production cost.

Engineers and Firemen. Water, Light and Fuel.

These are all strictly manufacturing accounts but in some cases a preference may prevail for showing a grouping of all power items including labor, under one heading.

Salaries (Portion of Executive).

There is no doubt that some portion of executive cost should be spread over production as the executors are important factors, and without them the goods could not be produced. Where certain officers devote their time to the producing department such time should be charged under this caption unless, perhaps, they receive a salary which is based on sentiment or on causes rather than on absolute merit in the work whether it be below or above what other equally competent men would be paid for the same work, in which circumstance a just charge should be made against manufacturing expense and the balance (be it a charge or a credit) under profit and loss account either direct or through the medium of commercial costs. The larger the factory, naturally the more executive officers there are and where different concerns desire a common standard the charge for executive expense per se, the basis of $1,500.00 per year against the manufacturing cost per $100,000.00 annual volume output is suggested, in other words, 1½ per cent of product, the remaining portion of the salaries paid being charged as already mentioned to profit and loss.

Superintendents, Foremen, Draftsmen, Etc.

The superintendents and foremen, draftsmen, time, and cost department, purchasing department, stores department and shipping department are all proper charge against manufacturing in machinery plants inasmuch as, with very few exceptions, all the product goes through the same course, although in many other lines of product different size orders of the same commodity receive different kinds of treatment.

Tool Making and Repairing.

An account dealing with tool making and repairing, tool boys, millwrights, inspectors, carpenters, etc., should be provided, this account being for general handy men around the shop. Where carpenters spend time on repairs such time is charged directly to a proper account covering the nature of the work done.

Painters.

The various painting operations on product are, as a rule, so briefly performed that it seems wise to diffuse this class of expense rather than attempt to apply it directly to shop order numbers.

Patent Costs.

There may be some variance of ideas on this subject for the reason that some concerns will take out patents on ideas that they do not expect to make use of. Such costs do not belong under manufacturing. Theoretically, patent costs should be spread over the life of the patent, but in this rushing age, patent ideas frequently become obsolete in five or ten years and the writer therefore feels that the arbitrary term of eight years is a very fair one, during which time such cost would be held in suspense and apportioned monthly over manufacturing costs on the annual basis of one-eighth of the entire patent costs.

Law Costs.

This account should not, of course, include such items as legal entanglements with customers, but should include those with supply houses having to do with raw material; judgment must, of course, be used in differentiating between the two classes of expense.

Strike Defense and Association Costs.

This includes any item of costs in connection with protection of other business organizations having to do purely with manufacturing.

Experimental Work.

It may seem at times unfair to charge to manufacturing such costs as have to do with new devices which possibly may come to naught and where such devices are put in work the proper procedure

[1]Eighth of a series of articles on Cost Keeping.
[2]Certified Public Accountant, Cincinnati.

is to give a shop order number with direct charges made thereto, the total of which may eventually find a resting place in loss and gain. Under manufacturing expense, experimental work should include only betterments or improvements on existing machines.

Incoming Freight, Express and Drayage.

Some concerns may prefer to add this cost to the material cost in the stock ledger which can be done at the option of the individual concerns without distributing the final cost, however, the plan of diffusing such costs is equitable and the more simple way.

Factory Supplies, Variation of Weights and Measures.

With the greatest possible care in details there will invariably be more or less shortage or overage in store room accounts, and in order to apply elements of safety to material each period, two per cent of the total amount of material used during the period should be charged to this account and credited to a reserve account against which reserve account can be charged any actual differences as they may be discovered.

Factor of Safety.

With the greatest possible care in details there will always be contingencies of one kind or other arising and to insure against such unforeseen, yet possible differences, a reserve account is suggested and each period a charge of two per cent should be made to manufacturing expense based on the total of such manufacturing expense before the factor of safety is applied.

Interest.

The matter of interest on investment is a moot question. If interest is charged without actually having been paid it must of necessity be credited to some representative account on the records and that account whatsoever the caption may be will come under the classification of revenues. In cases where two or more concerns are endeavoring to get their cost systems upon a standard basis the writer suggests that interest on real estate and factory buildings be charged into costs simply to the end that those concerns owning their plant may be put on the same basis as those concerns which pay rent for their ground or buildings or both. In fixing prices the loading which is put upon product to cover profit would naturally cover interest on investment. Tools and equipment, like men, unless they are working are earning nothing. Logically, if a portion of a certain plant is inactive for six months it would be unfair to burden the product of other departments with interest on the investment in the active departments, hence when the investor puts money into an enterprise he is taking chances on his returns unless he is buying preferred stock at a fixed rate of interest. The common stock may net 15 per cent the first year and through inactivities only three per cent the second year and nine per cent the third year, etc., and the portion of cost during inactive time is not a proper charge against the cost of machines constructed during the active time, hence, the writer suggests that when any interest on investment in equipment is charged at all it be a charge to loss and gain account for such period as the department is idle and not to manufacturing costs at all.

Maintenance.

Charging of items of this character to expense can be done either by making direct charges as the occasions arise or by creating reserve fund against which the actual costs can be charged as they arise, the expense account receiving each period an arbitrary pro rata. The latter plan appears to be the more equitable in that it tends to keep the expense constant more evenly averaged. Cases may arise where a large number of machines may need repairing in a single month and for several months following few or no repairs being made at all. As the time proceeds machines are gradually working up to the point of needing certain repairs and therefore theoretically, the cost should be spread over the time when the product is being benefited by such wear instead of charging the total amount in the period in which the machine is finally incapacitated.

Depreciation.

Depreciation of shop equipment is a subject upon which there is a wide diversity of opinion and upon which there is no generally accepted theory. It is customary in many shops to estimate the life of each building and each machine and so obtain an annual percentage which is charged to expense under the heading depreciation of buildings and depreciation of equipment, respectively. The element of antiquation also enters into the subject; that is to say, a lessening of value due to the approach of a time when it will no longer pay to use certain tools, though yet in good physical condition. With the advent of new machinery such antiquation is likely to happen like a continuous performance. In the matter of machine tools it has been argued that a much higher rate of depreciation be fixed for intricate machines than for simple machines; superficially, this appears to be so, yet on a closer analysis it appears differently. According to the list outlined in the foregoing, all maintenance of machine tools is charged to expense in addition to a percentage of depreciation so that it is evident that while the upkeep of the complicated machine will be much more expensive than the simple machine, yet it will not affect the ratio of depreciation for the reason that the upkeep expense will serve to prolong the life of the machine and it is safe to assume that this will equal the life of the simple machine.

A WELDLESS CHAIN MACHINE.

The Weldless Chain Co. of Chicago has been organized for the purpose of manufacturing a chain which is equivalent, it is claimed, to a forged steel chain. Such a chain has been made possible of manufacture by the building of a newly designed machine, all rights to which are controlled by the above company. The chain in the rough can be made directly from a bar of steel, at the rate of three feet per second, and under test, an example of which was the testing of a ⅜-inch

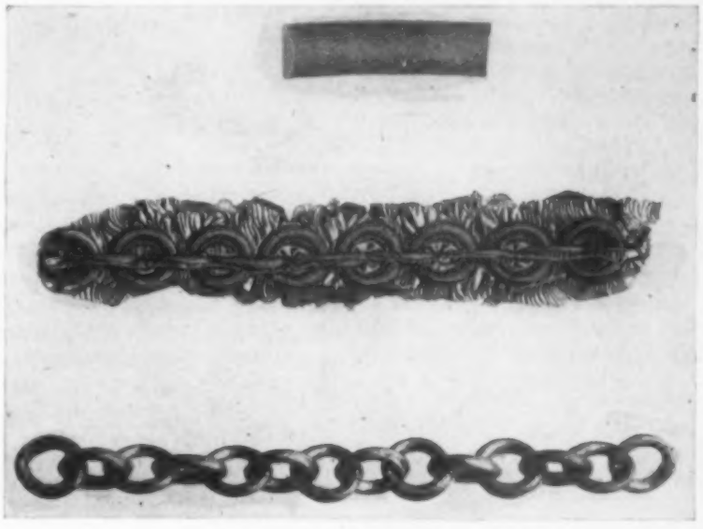


FIG. 1.—THREE STAGES OF CHAIN MAKING.

chain at the United States navy yard, Boston, will stand up to 7,330 pounds, which performance, though the test piece was somewhat imperfect, is slightly better than many test records on welded chain.

The principle of the operation depends upon a simultaneous impression of four dies acting with a movement perpendicular to the axis of the chain and at right angles to each other upon a steel bar heated to such a degree that it will have about the hardness of lead, so that when the dies are brought together a complete link shape is generated. This is the instantaneous principle, but in order to meet the condition of the interlocking links the bar must be fed in continuously, and consecutive impressions of the die must follow at a rate commensurate with the feeding speed, so that an unbroken succession of links or a chain may follow. It is also evident that the metal of the steel bar is drawn into the dies rather than vice versa, and as a result an enormous pressure is required, for withstanding which pressure the machine is heavily built. It is claimed as an additional advantage that this great pressure practically destroys whatever longitudinal grain may have previously existed in the bar, which is said to add to its strength.

FIG. 2.—ROLL.

To accomplish the above operations, four rolls have been designed beveled from each face at 45 degrees to a peripheral cutting edge, and so placed as shown in Fig. 3, which is a cross section through the chain machine, that the four cutting edges have instant contact at a common point. On each beveled face four endless dies are cut continuing around the entire circumference of the rolls. It will be seen in this arrangement that the forms on the two beveled faces of the same roll are 90 degrees apart and meet on the cutting edge, so that when the four rolls are brought together each roll contributes that part of the complete link form which lies in the four respective quadrants, and the cutting edge cuts out the metal completely except where it is pressed into the die form.

Each roll is made with a short shank, which is centered in the end of its particular driving shaft, so that the rolls may be changed for various sizes of chain. The shafts are driven by a train of correlated gears, so that the timing of each shaft is fixed, and there is no possibility of a lack of coincidence in the contact of the dies on each roll at the chain forming instant. In addition to charging the rolls for larger chains, the rolls are adjustable to provide for the various separating distances necessary. Fig. 2 is a perspective view of one of the rolls removed from the machine, showing the manner of forming the dies on its periphery, and Fig. 1 shows the three stages of the chain making operation, the first being the steel bar, the second the chain in the rough as it comes out of the die, and the third the finished output after having been put through a tumbler to remove the metal fins and webs not cleanly cut off during the forming operation. The chain in a finished condition is about three times as long as the original bar.

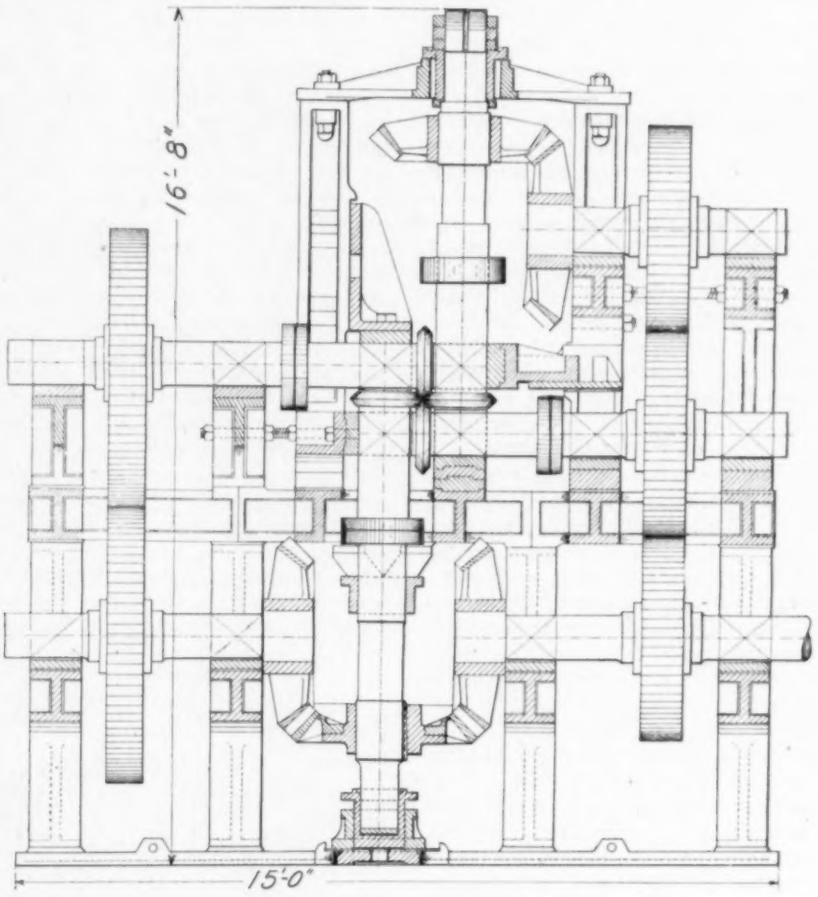


FIG. 3.—WELDLESS CHAIN MACHINE.

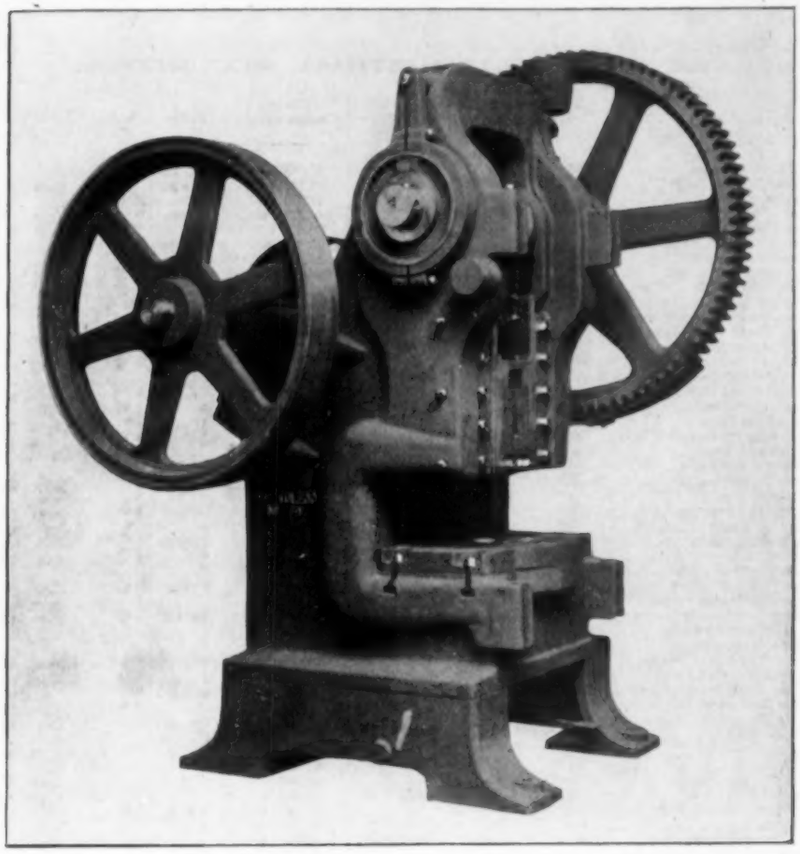
Large Contract Let.—Contracts have been awarded for changes in the entrance to the Manhattan side of the Williamsburg bridge, New York, to the F. W. Carlin Construction Co., on a bid of $404,865. The work involves the construction of a subway entrance to the bridge, a steel viaduct and masonry approach in addition to other changes.

A NEW REFRACTORY MATERIAL.

A new refractory material for use in pyrometer tubes, pipes, muffles, plates, crucibles, etc., is being introduced in this country by the Wilson-Maeulen Co., 110 Liberty street, New York. This material, which is known as electroquartz, is composed of fused silica, a pure silica product of the electric furnace. It is stated to have all the properties of the quartz product made from rock crystal except transparency. The maker states the material possesses a low coefficient of expansion, thereby permitting it to undergo violent temperature changes without cracking. It will withstand a temperature up to 1,400 degrees centigrade (2,552 degrees Fahr.), at which temperature it softens. The melting point is 1,600 degrees centigrade. Up to 1,300 degrees centigrade it may be safely used in contact with molten metals. The material is of vitreous texture and is hard and strong. The surface on one side is glassy and on the other is quite smooth. Tubes, crucibles, muffles, dishes, etc., made of this substance have a glassy surface on the inside, and in tubes of very small diameter both surfaces are glassy.

A POWERFUL BLANKING PRESS.

The accompanying illustration shows a powerful blanking press for producing large blanks or discs of heavy plate which were formerly made in single rotary slitting shears with circling attachments. The dies for work of this character in a press necessitate a powerful machine with an unusually large bed area and opening. The machine illustrated herewith is built by the Toledo Machine & Tool Co., Toledo, and has a capacity of cutting large blanks from steel plate ⅜-inch thick. The machine weighs about 18,500 pounds and has a bed 28 inches deep by 36 inches wide, the width between housings being 24 inches, with an opening in the bed 16 inches deep by 24 inches wide. The gap pattern is stated to be desirable for the convenience of the operator in feeding from right to left the heavy plates of bars for the rapid production of the finished work. The press has a stroke of 2 inches, which may be changed if desired. The adjustment of the slide is 4 inches and the distance from the bed to the slide is 13 inches. The distance back from the slide center is 8½ inches. The gearing, which is extremely powerful, has a proportion of 7½: 1, the diameter of the large gear being 61 inches. The balance wheel, 62 inches diameter, weighs 1,300 pounds. The belt pulleys are 24 inches diameter by 6 inches face.



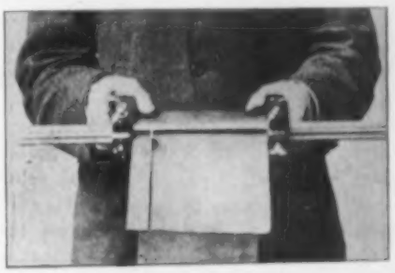
Toledo Press for Heavy Stampings.

HUDSON IRON CO. OPERATIONS.

The Hudson Iron Co. of New York, which a short time ago leased from Joseph Roseberry and brother the hematite iron mines south of Belvidere, N. J., has installed equipment and is now operating on a considerable scale. The mine was opened about 16 years ago, but operations were abandoned when a period of depression struck the iron industry and since that time the works have remained idle. The ore is worked through a shaft at a depth of about 100 feet, the mine being a washing proposition with an average iron yield of about 45 per cent. The same company has resumed operations on an extensive scale at its Beatyestown works, near Hackettstown. The mines here are of the open pit variety and their working has been much interfered with by reason of the inclement winter. The company has begun shipping over a connecting railroad, one and a one-half miles long, built during the winter.

THE MORE BELT CUTTER.

The accompanying illustration shows the More belt cutter which is designed to cut belts as wide as 16 inches and 100 feet in length into any lower width in less than ten minutes. It comprises, as shown, a pair of handles spaced on a bar which carries an adjustable cutting edge. The advantage claimed for this belt cutter is that a factory, instead of carrying all widths of belt in stock, can carry one large roll which can be cut up into narrower belts. The center may be cut from an old belt making a narrower belt which is still serviceable. The cutter is said to be indestructible and the weight of the device is ten pounds boxed.



The More Belt Cutter.

MINES INSTALL NEW AIR COMPRESSORS.

A number of mines particularly on the Gobebic and Michigan ranges have continued up to this time to use their first installations of power and air equipment. For the service now demanded new machinery is being recognized as a necessity and a number of compressors are being purchased or figured upon. As an example of the kind of units being obtained may be cited the Ingersoll-Rand compressors just ordered through the Duluth office of that company by Pickands, Mather & Co., for their Baltic mine on the Menominee range and the Cary mine on the Gogebic range.

For both mines the type of compressor is to be the same, being duplex Corliss with compound steam and air ends and heavy duty frame. The inlet air valves on both cylinders are of Corliss type with poppet discharge valves. Both machines are to be run condensing, using steam at 125 pounds and supplying air at 80 pounds. The compressor for the Baltic has a capacity of 3,000 cubic feet at 77 revolutions per minute and that at the Cary a capacity of 2,500 cubic feet of air at 91 revolutions per minute.

Financial Situation Greatly Improved.

A more hopeful and confident feeling as to the future movement of the market was apparent at the close of the past week in the stock trading field. After opening in a demoralizing fashion in which 35 active stocks declined to or below the lowest prices reached in the slump of March 14, establishing a new low average for two years, the market rebounded and trading during the remainder of the week ruled active and buoyant. Financially the week under review has shown great improvement and this is affording much encouragement to traders. Much of this favorable development has been due to the additional relief measures announced by Secretary of the Treasury Cortelyou. One of the official steps that aided in bringing about good results was the deposit of $15,000,000 custom receipts in the New York banks by the government under the terms of the Aldrich law and the accepting as security therefor of high grade securities and bonds. Likewise it was announced that the April interest on the public debt, amounting to $2,000,000, would be anticipated and immediately paid. Prompted by the monetary relaxation, call money dropped from 15 per cent on the opening day to 2½ per cent in a later period, and trading increased in good volume, resulting in substantial net gains generally for securities. There was a noticeable encouraging gain in investment buying. The New York bank statement was the best that has been issued in months, showing an increase of $12,800,000 in the cash reserve, and an increase of $8,400,000 in the surplus reserve. This raised the amount held by the banks in excess of their legal reserve requirements to $13,100,000, as compared with $5,100,000 a year ago, and $8,664,000 two years ago. Deposits increased $17,600,000 against an expansion of $6,500,000 in loans. Trading on the New York exchange for the five days of the week, the market having been closed Saturday for the Easter holidays, amounted to 5,922,850 shares, as against 5,743,450 last week and 4,384,310 the corresponding week in 1906.

Financial Notes.

The gross earnings of the railroads of the United States for the month of January aggregated $133,840,696, and the net earnings $36,287,044, according to the compilation of the *Financial Chronicle*. These figures compare respectively with the gross earnings of $123,664,663 and net earnings of $37,096,918 in 1906. The operating expenses in the two years were $97,553,652 in 1907 and $86,567,745 in 1906, an increase of $10,985,907, which overcame the increase in gross earnings of $10,176,033 and left a decrease in net earnings for the year over 1906 of $809,874. Attention is called to the fact that the weather in January, 1906, was unusually mild, while the conditions in January, 1907, were not at all auspicious for extraordinary activity of the railroads.

Recent dividend declarations include the following: Chicago Pneumatic Tool Co., quarterly dividend of 1 per cent, payable April 15; Nova Scotia Steel & Coal Co., the regular quarterly dividend on its preferred stock and 1½ per cent on its common stock, payable April 15; American Rolling Mill Co., regular quarterly dividend of 2½ per cent on the common and 1½ per cent on the preferred stock, payable April 15; Westinghouse Machine Co., quarterly dividend of 2½ per cent on the capital stock, payable April 10; R. D. Nuttall Co., a subsidiary of the Westinghouse Electric & Mfg. Co., 6 per cent dividend, making a total of 20 per cent for the year.

Announcement has been made by Edward B. Smith & Co., of the conclusion of the sale of $1,270,000 preferred stock of the J. G. Brill Co., car builder.

THE LEADING INDUSTRIAL SECURITIES.

	Closing Quo. Mar. 30	Changes In Week	Date 1907 Ann. Meet.	Stock Outstanding	Dividend Basis	Dividend Being Paid	Dividend Date Last Div. Pay.
Allis-Chalmers	12½	....	Sept.	19,820,000		.....	.....
Allis-Chalmers pr	28	+ ⅞		16,150,000	7 cum	.....	Feb., 1904
American Can	6¾	.....	Feb.	41,233,300		.....	.....
Am. Can pr	51	.....		41,233,300	7 cum	5 Q.	Apr., 1907
Am. Car and Fdy	35¼	+1⅝	June 27	30,000,000		2 Q.	Apr., 1907
Am. Car and Fdy pr	98	+1		30,000,000	7 n. c.	7 Q.	Apr., 1907
American Loc	62	+2	Oct. 5	25,000,000		1¾	Feb., 1907
American Loc. pr	103	−2½		24,100,000	7 cum	7 Q.	Jan., 1907
American Ship.	70¾	+1⅝	Oct. 2	7,600,000	6	1 Q.	Mar. 1907
American Ship. pr	108	− ¾		7,900,000	7 n. c.	1¾ Q.	Jan. 1907
Am. Steel Foundries	7⅝	− ⅝	Oct. 1	15 810,000		.....	.....
Am. Steel Foundries pr	36	−1		17,240,000	6 cum	.....	Aug., 1904
Barney & Smith	71	.....	June 4	2,000,000	4	4	Mar., 1907
Barney & Smith pr	135	.....		2,500,000	8 cum	8 Q.	Mar., 1907
Bethlehem Steel	12⅛	+ ⅛	April 2	14 862,000		.....	.....
Bethlehem Steel pr	49	+1		14,908,000	7 n. c.	5 Q.	Feb., 1907
Cambria Steel	35¼	.....	Mar. 19	45,000,000*	6	3 Q.	Feb., 1907
Cambria Iron	47	.....		8,468,000*	4	4 S. A.	Apr., 1907
Chicago Pneumatic Tool	45	.....	Feb. 18	6,145,800	4	4 Q.	Jan., 1907
Colorado Fuel	34¾	+2¼	Oct. 21	30,132,000		.....	Apr., 1902
Crucible Steel	85½	− ⅜	Oct. 16	24,578,400		.....	.....
Crucible Steel pr	70¾	+ ¾		24,436,500	7 cum	6	Mar., 1907
Empire Steel	8	.....	Feb. 27	2,281,400		.....	.....
Empire Steel pr	49	.....		2,500,000	6 cum	3 S. A.	July, 1906
Fay & Egan	95	.....	Feb. 19	1,000,000	6	7 Q.	Feb., 1907
Fay & Egan pr	128½	.....		1,000,000	7 cum	7 Q.	Feb., 1907
General Electric	145	+1	May 14	63,643,600	8	8 Q.	Jan., 1907
Harbison-Walker	10	+ ½	Jan. 21	18,000,000	6	.....	.....
Harbison-Walker pr	70	.....		9,600,000	6 cum	6 Q.	Jan., 1907
International Pump	27	−3	June 4	17,762,500		2	Apr., 1905
International Pump pr	75⅜	−3⅛		11,850,000	6 cum	6 Q.	Feb., 1907
Lackawanna Steel	50	.....	Mar. 13	34,971,400		.....	.....
Lake Sup. Corp	8	−1⅛	Oct. 2	40,000,000		.....	.....
New York Air Brake	111	−6	June 18	10,000,000	8	8 Q.	Jan., 1907
Niles-Bement-Pond	130	.....	Feb. 6	5,000,000	6	6 Q.	Mar. 1907
Niles-Bement-Pond pr	105	.....		2,000,000	6 cum	6 Q.	Feb., 1907
Otis Elevator Co	38	−2	March 18	6,350,300		3 A.	Apr., 1907
Otis Elevator Co. pr	85	.....		6,308,500	6 n. c.	6 Q.	Jan., 1907
Penn. Steel	65	.....	May 13	10,750,000		.....	.....
Penn Steel pr	99	.....		16,500,000	7 n. c.	7 S. A.	Apr., 1906
Pittsburg Coal Co	12⅛	− ⅛	Feb. 11	32,000,000		.....	Nov.....
Pittsburg Coal pr	51	.....		32,000,000	7	.....	Apr., 1905
Pressed Stl Car	34⅞	+2⅛	Feb. 20	12,500,000		3	Aug., 1904
Pressed Stl. Car pr	91	−1		12,500,000	7 n. c.	7 Q.	Feb. 1907
Pullman	160	+1	Oct. 17	100,000,000	8	8 Q.	Feb., 1907
Railway Stl. Spring	44⅛	+2⅛	Mar 7	13,500,000		4 S. A.	Mar., 1907
Railway Stl Spring pr	90	.....		13,500,000	7 cum	7 Q.	Mar. 1907
Rep Iron & Steel	25	.....	Oct. 9	27,191,000		.....	.....
Rep. Iron & Steel pr	80¼	−1¾		20,416,900	7 cum	7 Q.	Apr., 1907
Sloss-Sheffield	53½	+3⅛	Mar. 5	10,000,000	5	5 Q	Oct. 1906
Sloss-Sheffield pr	100	.....		6,700,000	7 n. c.	7 Q.	Apr., 1907
Tenn. Coal & Iron	139¼	+2¾	May 7	22,553,060	4	4 Q.	Feb., 1907
U. S. Pipe & Fdy	35	+ ¾	June 26	12,500,000	4	4 Q.	Dec., 1906
U. S. Pipe & Fdy. pr	76	−4		12,500,000	7 n. c.	7 Q.	Dec., 1906
U. S. Steel	35⅝	+1¼	April 15	508,302,500	2 n. c.	½ Q.	Mar., 1907
U. S. Steel pr	97⅞	.....		360,281,100	7 cum	7 Q.	Feb., 1907
U. S. Steel 5's	96⅜	+1⅛		463,798,000	5	5 A.	....
Va. Iron, Coal & Coke	65¾	+5¾	Sept. 17	8,641,600		.....	....
Westinghouse Elec	147	−3	July 24	24,998,700*	10	10 Q.	Jan., 1907
West'ghouse Air Brake	145½	−4½	Oct. 1	11,000,000*		22½ Q.	Jan. 1907

Par value of shares, $100, except those starred, $50.

NEWS FROM MANY INDUSTRIES.

New Buyers:—

The Union Iron Works Co., Houston, Tex., has increased its capital from $75,000 to $150,000.

The Kilby Frog & Switch Co., Birmingham, Ala., has increased its capitalization from $80,000 to $150,000.

The Aluminum Foundry Corporation, Southport, Conn., has increased its capital from $10,000 to $25,000.

The Calumet Steel Co., Chicago, has been chartered with a capital of $275,000 by Follett W. Bull, Louis Mannierre and E. Lundblad.

The Hunker Iron Works, Camden, N. J., has been incorporated with a capital of $50,000 by W. B. Wilhelm, J. E. Ferrier and M. J. Davis.

The Monitor Stove & Range Co., Cincinnati, has been incorporated with a capital stock of $100,000 by W. H. Schmidlapp, E. W. Hake and I. B. Resor.

The Lowith Bros. Iron Works Co., Denver, Colo., has been organized with an authorized capital of $2,000 by A. L. Lowith, Frank Lowith and David Goldstein.

The Koppe Bridge Co., Bryan, Tex., has been chartered with a capitalization of $16,000 by James O. Chances, John K. Parker, J. M. Lawrence and R. S. Newsom.

The Manufacturers' Foundry Co., Milwaukee, has been chartered with a capitalization of $200,000 by Bernard H. Berendsen, William A. Aschmann and Herman Freischmidt.

The Reading Oil & Gas Engine Co., Reading, Pa., has been incorporated with a capital stock of $200,000 by George H. Gerber, John S. Losch, Francis Keiser and MacHenry Wilhelm.

The Reeves Gas Engine Co., Columbus, O., has been organized with a capitalization of $75,000 by William A. Reeves, Edward R. Reeves, John F. Reeves, J. H. Holtermann and A. W. Shields.

The Russel Anti-Friction Drill Chuck Co., Elmira, N. Y., has been chartered with a capitalization of $15,000. The officers are: John M. McDowell, president and manager; Bertram W. Nye, secretary; Herschel L. Gardner, treasurer.

The Flexible Steel Lacing Co., Chicago, has been incorporated to manufacture steel lacings and coupling belts. The capital stock of the company is $25,000, and the incorporators are: A. B. Beach, G. E. Purple and P. S. Rinaldo.

The Sinz-Walling Co., Grand Rapids, Mich, has been incorporated with a capital of $60,000 and will make a specialty of high-grade gasoline marine engines and gas engine cylinder castings besides doing a general foundry business.

The Atlanta Pipe & Foundry Works, Atlanta, Ga., has applied for a charter to engage in the manufacture of castings, cast iron pipe and similar wares. The capital stock is $10,000, and the incorporators are: James E. Blecher, Ed L. Humphrey and W. L. Scott.

The Chattanooga Iron & Steel Co., Chattanooga, Tenn., has been chartered with an authorized capital stock of $125,000 to engage in the manufacture and sale of iron products. The incorporators are: Gary Schutte, Simon Muniskin, Edward Muniskin, Coral G. Neill and F. F. Smith.

The Sibley-Houfley Machine Co., Detroit, has been organized to manufacture automobile parts and gas engines. The capital stock is $500,000, and the officers are: President and treasurer, M. M. Sibley; secretary, A. H. Sibley, and vice president and manager, F. J. Houfley.

The Christy Steel Co., Akron, O., has been formed with a capital stock of $50,000 by James Christy, F. D. Kidder, Frank W. Rieske, A. K. Kronk and James W. Orr. The company will manufacture crucible steel and nickel steel castings for automobile and machine parts.

The American Machine & Mfg. Co., Charlotte, N. C., has been granted a charter to manufacture hydraulic, steel, electric and transmission machinery and install the same. The authorized capital stock is $300,000, and the incorporators are: D. A. Tompkins, J. W. Conway and S. B. Sargent.

Jenkins Bros., 800 Magnolia avenue, Elizabeth, N. J., have been chartered to manufacture valves, lubricators, injectors, machinery, etc., by Henry D. Gordon, A. Eugene Brady and Frank T. Swain, all of the above address. The capital stock of the company is $750,000.

The Wood & Iron Works Co., Wadesboro, N. C., has been chartered to carry on the business of mechanical and electrical engineers, toolmakers, machinists, founders, etc. The authorized capital is $25,000, and the incorporators are: I. H. Horton, W. B. Kerr, T. H. Bennett and others.

The Ames Automatic Machinery Co., Spokane, Wash., has been incorporated to manufacture an automatic fire escape invented by Rufus Ames. The capital stock of the company is $200,000, and the officers are: Rufus Ames, president; Robert Dowling, vice president, and Capt. John Gray, secretary and treasurer.

New Construction:—

The Reading Iron Co., Reading, Pa., is planning to shortly begin the erection of new and modern machine shops.

The Michigan Stove Co., Detroit, is preparing to erect a new foundry building 126 x 126 feet in dimensions.

The Central Metal Supply Co., Baltimore, has awarded the contract for the construction of an addition 56 x 59 feet to its plant.

The Nordeen Iron Works, Everett, Wash., has begun the construction of a new foundry. The necessary equipment has already been purchased.

The Milwaukee Steel Foundry Co., Milwaukee, has purchased five acres of land near that city and will erect a plant 100 x 224 feet on the site.

The Oneida Steel Pulley Co., Oneida, N. Y., is making preparations to build a large addition to its plant in order to keep pace with its expanding business.

The Lannon Machinery Co., Pueblo, Colo., has begun the reconstruction of a large corrugated iron and frame building at its plant to replace the structure recently damaged by fire.

The Southwestern Iron Co., Guthrie, Okla., has decided to increase the capacity of its foundry by building an addition to its plant which will practically double the present output.

The Peru Plow & Wheel Co., Peru, Ill., has awarded the contract for the rebuilding of that portion of its plant which was recently damaged by fire. The new building will be 100 x 150 feet, two stories high.

Bridgman Bros. & Co., Philadelphia, have awarded the contract for the construction of a large addition to their plant. The building will be five stories in height of concrete construction and 90 x 90 feet in dimensions.

The Sterling Engine Co., Buffalo, N. Y., has taken out a municipal permit for the erection of a two-story brick machine shop to its plant. The company has recently increased its capital stock for this and other extensions.

New shops are being erected by the Savill-Chandler Co., Canton, Ill., for the accommodation of its foundry and machine business. The new plant will be equipped with modern machinery suitable for the building of mining cars and machinery.

The Waclark Wire Co., Rahway, N. J., has awarded the contract to the H. Wales Lines Co. for the construction of a new copper wire mill at that place. The building will be 53 x 203 feet in dimensions and two stories high of mill construction.

The F. A. Klaine Co., Cincinnati, O.,

is planning the erection of a new molding shop to its stove foundry, 82 x 101 feet, one story high of brick and steel construction. The present pattern shop is to be replaced by a four-story building, which will be a pattern shop and warehouse combined.

The Kansas City Railway Foundry Co. is erecting a plant in Kansas City, for the manufacture of lubricating cups and journal boxes for use on street cars under a patent devised by John Rogers of that city. A. F. Reitz is president, O. M. Hunt, vice president, and R. H. Weber, secretary and treasurer.

The contract for the construction of a new foundry building for the Nute Foundry Co., at Cuyahoga Falls, O., has been let, and work has been inaugurated. The company has just completed the erection of a temporary office building on the site. When the building is completed the plant at Akron will be removed to it.

The Keystone Steel Casting Co., Chester, Pa., recently organized, states that it is about to place contracts for the erection of its buildings, and also for crucible and annealing furnaces. Building operations will begin as soon as these contracts are placed. The company will shortly require some machine tools, such as shapers, planers, etc.

The Stover Mfg. Co., Freeport, Ill., has begun excavation for the erection of a new foundry. The building will be 85 x 300 feet in dimensions, considerably larger than first contemplated, and will be of brick and steel construction. Several other structures are to be erected during the coming season by the concern. Work on a new machine shop is now under way.

The Industrial Works, Bay City, Mich., is contemplating the erection of a steel foundry plant during the coming summer. The main building of the plant will be 130 x 250 feet, and will be equipped with modern appliances. The concern has also recently purchased an extensive tract of ground and will build thereon a new erecting shop 160 x 300 feet. Other extensions are planned.

The Dickson Car Wheel Co., Houston, Tex., is pushing the construction of its extensive new plant in that city. The main building is 135 x 268 feet. Its equipment will be electrically driven and will be modern in every respect. In addition to the main building, a power plant, 40 x 72 feet, core building, 38 x 100 feet, and a storage house, 28 x 68 feet are being constructed.

The Duer-Elderkin Spring & Mfg. Co., offices and works, Twenty-sixth street and Liberty avenue, Pittsburg, has purchased a tract of land at McKees Rocks on which it will erect a one-story building 50 x 140 feet to provide for increased facilities. The company manufactures elliptical springs and will maintain hot and cold departments, adding some new modern machinery to the latter.

The Seaman-Sleeth Co., Pittsburg, has purchased a tract of land in that city on which it will erect a steel building 40 x 150 feet to be used as a machine shop. The building will be equipped with a 30-ton electric crane for handling heavy work and also modern machine tools, motor driven. The company contemplates the erection of another steel building to contain two 25-ton open-hearth steel furnaces and a foundry.

The Southern Engine & Boiler Works, Jackson, Tenn., has under construction an extension to its power shop, 100 x 150 feet, which it expects to have completed in 30 days. The concern has also acquired additional real estate for the future extension of its plant, but plans for new buildings have not fully matured. All material and equipment for the extension now under construction have been purchased.

The Chattanooga Implement & Mfg. Co., Chattanooga, Tenn., states that it is now completing a first-class power plant, and has contracted for an Allis-Chalmers Corliss engine direct-connected with a Bullock generator. The plant will be equipped with Bullock motors, all of which have been purchased. The power plant is the forerunner of some additional building that the company expects doing the latter part of the year.

The Hayden-Corbett Chain Co., Columbus, O., has started the erection of a new link shop. This shop will be a complete unit, as it will have its own power, electrical apparatus and other equipment that will make it independent of the remainder of the plant. It will be of brick with asbestos roof, entirely fireproof and will have a ground plan of 40 x 214 feet. Railroad switches will be run into it so that the material can be handled in the most economical manner.

The Ohio Steel Foundry Co., Lima, O., recently incorporated, is now at work constructing its plant at that city. The entire outfit is being put in on the unit plan, with special attention to the passage of materials through the plant. All machines will be driven by individual motors. The buildings contain as much glass as is possible to put in them in order to give good light in the day and at night they will be illuminated with Cooper-Hewitt lamps. The boiler house will contain two water-tube boilers, 200 horsepower each, with room for two additional boilers. It will also contain the necessary heaters, pumps, etc. The engine room will contain one 150-kilowatt direct-connected generator with Corliss engine driving it, and also a 1,100-foot Ingersoll-Rand air compressor. The power house building itself will be absolutely fireproof, having brick walls, steel trusses and reinforced corrugated asbestos roof. Particular attention is being paid to levels and drainage, the buildings being set on a common level several feet above the surrounding surfaces. The main building will be 167 x 300 feet, the power house, 50 x 80 feet; pattern shop, 50 x 56 feet; pattern storage, 60 x 150 feet, and storeroom, 30 x 70 feet. All pipe will be exposed and accessible and all electric wiring will be in conduit. The saws and machines in the finishing department will all be built for and will use high-speed steel.

General Industrial Notes:—

The Washington Sheet Metal Works, Seattle, Wash., recently organized has leased a large building suitable for its purpose.

The Republic Construction Co., Cleveland, whose plant was recently destroyed by fire, states that it will repair the building burned, but will do the work itself.

The Philadelphia Steel & Wire Co., Philadelphia, Pa., has just completed a reinforced concrete addition to its mills in Camden, N. J., which will be used for the finishing of rods for concrete work and other specialties.

The Velte Foundry & Machine Co., Pittsburg, Pa., has started its side blow converter for small steel castings. The company expects to take up the manufacture of such converters in sizes from one to five tons capacity.

The Utica Pipe & Foundry Co., Utica, N. Y., states that its plant was not very badly damaged by the recent fire. Repairs are now under way and operations will be resumed within a few days. In the meantime the company's other two plants are in operation.

At the meeting of the stockholders of the Ireland Machine & Foundry Co., Norwich, N. Y., it was decided to increase the capital stock from $25,000 to $50,000. The number of directors was also increased from six to nine and S. A. Jones, W. H. Wells and N. P. Bonney were elected to the positions thus created.

The Florida Ornamental Iron Works, Jacksonville, Fla., recently organized, has installed a plant where it will manufacture ornamental and structural iron work, making a specialty of iron fences, gates, etc. The officers of the company are: President, D. L. Rathbone; vice president, J. J. McNamara, and secretary-treasurer, I. S. Zeller.

The Canton Brass Co., Canton, O., recently incorporated, reports that it is a new concern starting the manufacture of brass goods to be used for steam. It will also do a general jobber's business in brass, aluminum and bronze. A factory has been completed and put in ope-

ration. All the equipment has been purchased. Frank C. McLain is president.

The Baker-Churchill Co., Detroit, Mich., recently incorporated, will engage in the manufacture of general oiling devices, making a specialty of the Churchill mechanical oiler and automatic, gravity and pressure multiple oilers. The company will also specialize in the line of automobile and marine engine oilers. At present the equipment is adequate and quarters are being leased.

At the annual meeting of the Hendey Machine Co., Torrington, Conn., manufacturer of special machinery and tools, Frederick F. Fuessenich was elected president to succeed the late Henry J. Hendey. Mr. Fuessenich retains the position of treasurer, which he has held for some time. Charles H. Alford was promoted from secretary to vice president and general manager, and Frederick N. McKenzie was chosen secretary.

The Bennington Typewriter Co., Columbus, O., has been reorganized by the election of the following officers and directors: W. E. Bennington, president; George H. Watkins, vice president; Opha Moore, secretary; Dr. W. A. France, treasurer. These, with B. C. Kelsey, M. W. Powell of Chicago, William H. Meek of Dayton, F. J. Norris of Cincinnati, and William J. Diehl of Wheeling, form the board of directors.

It is announced that the Union Hardware Co., Torrington, Conn., has taken over the business of the Bridgeport Gun Implement Co., which was a branch of the Union Metallic Cartridge Co., of Bridgeport. The Union company, which has made a specialty of skates and hardware, recently began the manufacture of gun implements, and its recent acquisition will enable it to expand this branch of its operations. The company is making extensive additions to its plant.

Incorporation papers for the new $500,000 steel and malleable castings company that is being promoted by capitalists of Columbus, O., will be ready to file with the secretary of state within a few days. The president and general manager of the company have been selected and an option has been taken on the old plant of the Columbus Malleable Co., on North Fourth street, Columbus. The promoters do not expect it to take more than a few weeks to remodel the plant for the new business.

Trade Notes:—

The Case Mfg. Co., Columbus, O., has contracted to furnish a number of large cranes for the new plant of the American Steel & Wire Co., to be erected at Cleveland.

The government has placed an order with the Columbus Anvil & Forge Co., at Columbus, O., for 100 anvils of a special make. They are for the cavalry service and so constructed that they can be carried in cases by the cavalrymen.

A very large shipment of double swivel vises has just been made from one of the factories of the Pittsburg Automatic Vise & Tool Co., to Cologne, Germany. This is but one of the many foreign orders that are continually being shipped by the Pittsburg concern.

The Union Steam Pump Co., Battle Creek, Mich., wants catalogs of boilers and engines. The company is figuring on three 150-horsepower boilers or larger, also on 150 to 200-horsepower engines, self-contained, direct-connected to generators. Address all catalogs to general superintendent.

The Pittsburg Automatic Vise & Tool Co. is considering the starting of a plant across the Atlantic in view of the phenomenal growth of its export business and its numerous inquiries from civilized countries. It is believed that such a step would not only permit of much quicker delivery of its vises, but would relieve the very heavy strain which is now upon the home plants.

The Wilson Aluminum Co., Cedar street, New York, announces the sale of its plant at Kanawha Falls, W. Va., to the Electrical Metallurgical Co., with general offices at 157 Michigan avenue, Chicago, Ill., and 79 Wall street, New York. The sale includes the business of the Wilson Aluminum Co., good will and patents, insofar as they relate to the manufacture and sale of ferro-alloys. Among the numerous patents acquired are those covering the manufacture of ferro-chromium, ferro-silicon and other ferro-alloys.

The Avery Stamping Co., Cleveland, is calling attention to its improved facilities for producing pressed steel work between 18 gage and one inch in thickness. This material serves a large variety of uses from automobile construction to kitchen utensils. One of the largest hydraulic presses in use for pressed steel work is installed at its plant, as well as full equipment of other necessary machinery for turning out a high grade of product. Particularly is attention called to the fact that its ware is drawn to a uniform thickness throughout, according to specifications, without spinning. In view of the many instances where pressed steel work may be employed to greater advantage than cast or malleable material, the Avery Stamping Co. may be able to serve to the best advantage many requirements.

The Reese-Hammond Fire Brick Co., Pittsburg, manufacturer of fire brick and other clay products, has recently furnished brick for the following repairs and improvements: Anti-koken Iron Co., Port Arthur, Ont., one furnace, three hot blast stoves and 100 beehive coke ovens; Corrigan, McKinney & Co., Cleveland, one furnace, four hot blast stoves for its Josephine plant, and a partial relining for its Scottdale, Pa., furnace; Crane Iron Works, Castasauqua, Pa., blast furnace; Warwick Iron & Steel Co., Pottstown, Pa., blast furnace; Joseph C. Thropp, Everett, Pa., two blast furnaces and two stoves; Shenango Furnace Co., Pittsburg, partial relining for one furnace, and lining for new furnace ready for shipment; Rome Furnace Co., Rome, Ga., blast furnace.

This concern recently completed a large number of coke oven contracts, and in addition to the orders named above, reports a very satisfactory amount of business on its books at present.

Fire brick values are reported somewhat lower than they should be, considering the present condition of the iron market, although the situation is said to be more satisfactory, and the prospects generally for a large volume of business throughout the year at fair prices are very encouraging.

The sales department of the Quincy, Manchester Sargent Co., will be removed from Plainfield, N. J., to the new West street building, 90 West street, New York, April 1.

Fires:—

The plant of the American National Machine Co., Goshen, Ind., was badly damaged by fire March 20.

The plant of the Champion Drill Co., Avon, N. Y., was destroyed by fire March 19, causing a loss estimated at $20,000. A number of valuable patterns were saved.

Fire at the stove foundry of the A. J. Lindeman & Hoverson Co., Milwaukee, caused damaged to the manufactured stock estimated at $10,000. The building was only slightly damaged.

The general shops of the El Paso & Southwestern railroad at Carrizo, New Mexico, including the round house and car shops and five new engines, were badly damaged by fire March 27, causing a loss of about $150,000.

The plant of the Maryland Steel Car Wheel Co., Baltimore, Md., suffered from a fire loss estimated at $50,000 March 29. The car wheel company is an affiliated concern of the South Baltimore Steel Car & Foundry Co., which has suffered three severe fires in its various plants since November, 1906. The previous fires were in the riveting building, truck and axle shop.

TRADE PUBLICATIONS.

Round and Square Bars, Turnbuckles, Etc.—The Cleveland City Forge & Iron Co., Cleveland, presents a catalog of 56 4¼ x 7-inch pages, giving information of value to engineers and builders in regard to turnbuckles, clevis nuts, car forgings, bolt ends, upset screw ends, etc. Dimensions and weights of the various manufactured products are given in the form of tables, and in addition, there are tables of useful information comprising dimensions of standard bolts and nuts, weights of nuts, tables of wire and sheet metal gages, round and square bars, decimals of feet and inches, etc. The book is bound in leather, and in the back are about 20 pages of blank cross sectional paper for notes and additions.

Ash Handling Systems.—The Jeffrey Mfg. Co., Columbus, Ohio, has issued a 12-page pamphlet 6 x 9 inches, illustrating a number of grab bucket systems for handling coal and ashes in power houses. Photographs of a number of actual installations are presented. Another pamphlet presents illustrations installed by the Jeffrey Co. of other types of coal handling machinery.

Cement Making Machinery.—The Power & Mining Machinery Co., Milwaukee, has published an 85-page 6 x 9-inch catalog of cement making machinery, illustrating crushers, crushing rolls, screens, dryers, tube mills, kilns, etc.

Wood Working Machinery.—The H. B. Smith Machine Co., Smithville, N. J., is distributing extra pages for its catalog, illustrating and describing a combined surface planer and matcher, an extra heavy 12-inch outside molding machine, a double spindle shaper for brush backs, etc., and a heavy jig saw.

Cement.—Universal Portland Cement Co., Chicago and Pittsburg. Catalog, 6 x 9 inches, 72 pages. Describes the process of manufacture of its Portland cement and opens with a statement of the formation of this company on Oct. 1, 1906, as a new subsidiary of the United States Steel Corporation. On that date this concern took over the plants and business of the cement department of the Illinois Steel Co. The present output of 6,500 barrels of cement at South Chicago and Buffington, Ind., is being increased by a new plant at the latter place, which will have a capacity of 6,000 barrels, and a new plant at Universal, near Pittsburg, which will have a capacity of 4,500 barrels. When the two plants are placed in operation the total output of the Universal Portland Cement Co. will be over 17,000 barrels daily. The catalog is replete with illustrations of bridges, buildings and other structures built with Universal Portland cement, and also contains a large number of testimonial letters.

Cupola Linings.—Harbison-Walker Refractories Co., Pittsburg. Booklet, 3¼ x 6 inches. 15 pages. Contains a talk on brick for cupola linings, which is addressed to the foundry superintendent, and is intended to acquaint the shop management with the fire brick cupola linings manufactured by this company. The booklet contains many valuable suggestions regarding the laying of cupola blocks and bricks, as well as mixtures of material best suited for daubing and patching. The booklet is only intended to cover brick for cupola linings, as the company has a standard catalog which covers all the lines of refractory materials it manufactures.

Ferro-Silicon.—A phamplet distributed by the Roessler-Hasslacher Chemical Co., 100 William St., New York, presents the advantages of the use of high grade ferro-silicon in the foundry and in steel works. It summarizes the principal advantages claimed for high-grade ferro-silicon, as compared with low-grade as follows: Used in the foundry, it dissolves easily without consuming great heat in the molten cast iron, and it is possible to obtain, without changing the charge of the cupola, the required qualities of cast iron for different varieties of castings. In steel works it insures purity of the finished product and may be added to the steel bath in the ladle without previous heating. The loss of silicon is reduced to a minimum. As a producer of heat, it consumes an insignificant quantity of heat when dissolving in the bath and immediately develops heat.

Controllers.—Type G controllers are described in a sectional catalog issued by the Electric Controller & Supply Co., Cleveland. This controller has been designed to meet the persistent demand for a moderate priced, self-contained controller from 1 to 50 horsepower. Two types of controllers are built with coil resistance only in sizes of from 1 to 50 horsepower for 220 or 500 volts. Two other types are built from 1 to 50 horsepower with cast grid resistance for 220 volts only.

Steel Blocks and Tackle.—Bulletin H-20 issued by the Columbia Steel Co., Portland, Oregon. Describes cast steel blocks and loggers' tools. A great variety of blocks are illustrated, with one or more sheaves.

Rock Drills.—The Ingersoll-Rand Co., New York, in catalog No. 46 describes the Rand rock drill. The catalog is 6 x 9 inches and contains 42 illustrations. It describes the Rand drill fully in all its details, and gives full information as to sizes, capacities and other desired particulars, including prices.

FOREIGN TRADE OPPORTUNITIES.

(These inquiries from prospective foreign purchasers are furnished by American consuls to the Government Bureau of Manufactures, Department of Commerce and Labor. Those in which the addresses are omitted are on file at the Bureau of Manufactures, Washington, D. C. In applying for addresses refer to the file number.)

No. 773. Motor boats and engines.—Manufacturers of motor boats and motor engines for motor boats and dealers in motor-boat supplies are requested to send full information, circulars, and catalogues to an American consulate in the United Kingdom, who will forward the literature to a new motor-boat club. In each instance there should be forwarded a number of copies for the purpose of distribution among club members.

No. 776. Screw machines.—Steinfeldt & Co., Viehofen, Austria, want to buy automatic machines to produce daily from 500 to 1,000 gross of wood screws.

No. 778. Machinery and equipment.—An American consul in a Spanish-American country suggests that manufacturers of equipments and supplies for electric street car lines, waterworks, and drainage systems should correspond with a construction company at the city in which he is located, as the company is almost constantly in need of supplies and equipments.

No. 779. Builders' supplies.—The same consul as of No. 778 furnishes the addresses of two firms which are constantly in construction work of many kinds, and which especially need builders' supplies and structural material.

No. 781. Railway construction.—It is announced that on July 1 at St. Petersburg the Finance Department of Russia will let contracts for Amur railway construction at an estimated cost of $88,095,000.

No. 787. Railway construction.—The Government Gazette of the Orange River Colony publishes an Inter-Colonial South Africa Order-in-Council, authorizing the borrowing of the following sums of money for railway construction: $438,000 from the government of Basutoland for the construction of the Maseru Railway; $1,750,000 from the Transvaal Post-Office Savings Bank Investment Board for the construction of the Brakpan-Witbank Railway; $122,000 from the municipality of Ladybrand for the construction of the Ladybrand-Modderpoort Railway; $2,263,000 from the Transvaal government for the expropriation of the Ermelo Railway Co., and the construction of the Machadodorp-Ermelo Railway; $2,000,000 from the Orange River Colony government for the construction of the Bloemfontein-Kimberley Railway.

No. 789. Electric tramway plant.—The Levant Herald reports that the Turkish government has prolonged the concession of the "Societe des Tramways de Constantinople" until the year 1993, and the company has undertaken to substitute electric for animal traction, and to construct within five years three newlines: (1) To Pera, from the Galata-Serai tunnel; (2) from Pancaldi to Tatavla; (3) to Stamboul from the Mosque of Fatih. They have also undertaken to double the present line from Galata to Ortakeny.

No. 794. Flour mill machinery.—An Oriental flour mill company states to an American consul that it is prepared to consider proposals for American milling machinery and supplies.

No. 795. Electric tramways.—Detailed information has been received by the Bureau of Manufactures from American consular officers concerning the proposed construction of two new electric car lines—one in a Latin American city, the other in the Orient. The consuls indicate that there is an opportunity to supply American electric and railway supplies.

No. 812. Cotton machinery.—The *Bulletin Commercial*, of Brussels, reports that the Colombian government has entered into a contract for the establishment of a spinning and weaving factory in Colombia. The equipment will be purchased abroad. For further information address the Minister of Public Works, Bogota, Colombia.

No. 825. Railway bridges.—(1) Consul M. K. Moorhead sends from Belgrade blue prints and complete specifications for material for iron bridges for the Servian State Railway. Tenders for this material must be received by the Director of the Servian State Railway by April 15. The blue prints, etc., will be loaned to bridge manufacturers by the Bureau of Manufactures. (2) Consul Ernest L. Harris of Smyrna, reports that the Aiden Railway Co. has secured a concession for extending their line 65 miles, and American bridge builders may be able to secure orders for supplies.